The Relationship Between Performance on a Prototype Measure of Perceptual Defence/Vigilance and Psi Performance.

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To my parents

Abstract

Based on the premise that psi information is initially processed at an unconscious level, parapsychologists have repeatedly drawn parallels between subliminal perception and extrasensory perception. For instance, defensiveness - resistance to, or distortion of, unpleasant or threatening information - has been considered to affect both subliminal and extrasensory perception. This thesis reviews studies suggesting a relationship between 'defensiveness' and psi performance, and reports the outcome of a meta-analysis of a subset of these studies that used the Defence Mechanism Test as a measure of defensiveness. The review and meta-analysis suggest that there is a need for independent replication of the defensiveness-psi findings, and for an extension of this line of research. Difficulties with the various methods used for measuring defensiveness are identified, and the development of an alternative, prototype measure of 'perceptual defence/vigilance', using a 'subliminal perception' paradigm, is described. Seven experiments are conducted to explore the relationship between defensiveness and psi using this prototype indicator. The first three are preliminary studies aimed at developing the prototype indicator of perceptual defence/vigilance, and in two of these studies comparisons are made between perceptual defence/vigilance and psi performance. Experiment 4 describes a systematic comparison of perceptual defence/vigilance and ESP performance, while experiment 5 compares defensiveness with ESP scoring before and after training with various mental techniques reputed to enhance psi performance. Experiment 6 explores variations in methodology and scoring systems associated with the prototype measure of perceptual defence/vigilance. Experiment 7 compares perceptual defence/vigilance and ESP performance, including a theory-based examination of 'implicit' and 'explicit' measures of defensiveness and ESP. The main findings of these experiments are that perceptual defensiveness/vigilance consistently correlates in the predicted direction with PK, with forced-choice ESP, and with 'unconscious' ESP, but that there appears to be no systematic relationship between defensiveness and free-response ESP before and after training. Importantly, there is also a consistent correlation between defensiveness and a questionnaire measure of neuroticism, that provides converging evidence of the validity of the prototype indicator of perceptual defence/vigilance. The final chapter summarises and synthesises the findings of the experiments conducted, and makes suggestions for future research. It is concluded that while there is a need for further, more systematic development of the perceptual defence/vigilance apparatus, these experiments have shown the potential of this prototype indicator to be a useful tool, both for parapsychologists wishing to explore the psi process, including its relationship to defensiveness, and for psychologists interested in enhancing human performance.

Contents

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Declaration

I have composed this thesis, and the work is my own.

Caroline A. Watt

Chapter 1. Introduction, definitions and outline of thesis.

> It is here, in the common unconscious functions of both sensorimotor and extrasensorimotor (or psi) character that parapsychology comes closest to psychology (Rhine, 1977, p171)

With these words, J.B. Rhine, the founder of experimental parapsychology, expressed a sentiment echoed in the thoughts and researches of many parapsychologists: the remit of parapsychology and psychology can overlap considerably. Indeed, the word para*psychology* itself suggests that the discipline of psychology has much to offer the relatively young field of scientific research into ostensibly paranormal phenomena. Perhaps, in turn, some of the pioneering research techniques and findings of parapsychology may contribute to the development of psychology.

The considerable commonalties between the research approaches and findings of psychology and parapsychology have been illustrated by Irwin (1979), Child (1985); and Schmeidler (1988) has comprehensively reviewed the similarities and dissimilarities between the two disciplines. For instance, the social dynamics of the experimental setting (such as subjects' and experimenters' attitudes and expectations) have been shown similarly to influence the outcome of both psychological and parapsychological studies (e.g. Rosenthal, 1966; Harris & Rosenthal, 1985; Crandall, 1985; Taddonio, 1976; White, 1977). The 'ganzfeld', a technique for inducing an altered state of consciousness that was first introduced into parapsychology in 1974 by Charles Honorton (Honorton & Harper, 1984), has its origins in studies of the psychology of perception (e.g., Avant, 1965); today, parapsychological studies using the ganzfeld technique are regarded as providing some of the best evidence for a replicable psi effect (e.g. Utts, 1991).

One area of overlap between psychology and parapsychology which has excited a great deal of interest in the last 30 or so years is that concerning the perception of, and reaction to, information (such as a weak visual stimulus) of which an individual is not consciously aware. In the past, such unconscious perceptual processes have been termed 'subception' (Goldiamond, 1958), or perhaps most commonly 'subliminal perception' (Dixon, 1971); more recently, as computer and information processing metaphors influenced psychologists' thinking, and signal detection techniques revealed that there was no such thing as a fixed or absolute sensory threshold or limen (e.g., Swets, 1964), terms such as 'preconscious processing' (Dixon, 1981) and 'unconscious cognition' (Greenwald, 1992) have become popular. It was found that individuals varied in their responses to subliminal stimulation (e.g. Eagle, 1962), and psychologists and parapsychologists remarked upon the similarity between the impact of individual differences on subliminal perception and on extrasensory perception (e.g. Dixon, 1979; Roney-Dougal, 1986, 1987; Schmeidler, 1986, 1988).

Phenomenologically, subliminal and extrasensory perception appear to have many similarities. Individuals may find it difficult to distinguish between subliminal perception and extrasensory perception; indeed there have been studies in subliminal perception which have been disguised as ESP studies (Calvin & Dollenmayer, 1959; Miller, 1940) and ESP studies which have been disguised as subliminal perception studies (Lovitts, 1981; Tart, 1963; Nash & Nash, 1963). The question has even been raised whether subliminal stimulation is actually 'psi in disguise' (Roney-Dougal, 1982, p.99).

Conversely, significant scoring in early ESP experiments has been attributed to methodological flaws that could have enabled the subjects to pick up minimal or subliminal cues as to the target identity (Kennedy, 1939). In both subliminal perception and extrasensory perception, subjects may feel like they are simply guessing the nature of the stimulus or target (Roney-Dougal, 1986; Schmeidler, 1986), or the stimulus information may appear almost incidentally in the subjects' cognitions (Irwin, 1979). In her report of an exploratory study and a lengthy follow-up study comparing psi with subliminal perception, Roney-Dougal concluded:

> SP (subliminal perception) is as affected by psychological variables as other parapsychologists have found psi to be...At both an objective and a subjective level, it was impossible to tell whether a particular session had been a psi or an SP one; there seemed no clear way of differentiating between the two at the response side of the process, although they are quite clearly different at the stimulus side. (Roney-Dougal, 1987, p.174)

While it is not yet known by what means information is perceived 'extra-sensorially' (and some consider it has not even been demonstrated *that* such extrasensory information transfer occurs, e.g., Kurtz, 1985), many lines of parapsychological research have been stimulated, like J.B. Rhine, by the notion that extrasensory information may be unconscious to begin with, and that individual differences in perception, cognition, personality, and motivation may similarly affect the emergence of extrasensory and subliminal information into conscious awareness. This model of psi processing (developed by Tyrrell, 1947, and later adopted by L.E. Rhine, 1962, and 1967) has come to be known as the 'two-stage' theory of psi, and since it provides the foundation for comparisons of subliminal and extrasensory perception, it will be briefly described.

The two-stage theory of psi processing. In his work *The* Modus Operandi *of Paranormal Cognition,* Tyrrell (1947) was the first to propose the theory that psi information is initially 'perceived' at an unconscious level, and that this information may be subject to distortions and transformations before it emerges at a conscious level, in the same way as normally-perceived information may be distorted. An extract from Tyrrell's *Summary of Conclusions* best conveys those aspects of his theory most relevant to the present thesis:

> (1) Paranormal cognition is not a conscious *process*. Its *product* alone is revealed to consciousness.
> (2) This product is here called a "mediating vehicle". It is subconsciously created by the percipient.
> (3) The mediating vehicle is not a paranormal phenomenon but is the product of psychological machinery which all possess. It may take the form of a sensory hallucination or of an impulse or of automatic verbalization or of a dream
> (4) The same vehicle which mediates paranormal cognition also mediates subconscious expectations and beliefs or normally acquired knowledge which has not reached consciousness independently. In these latter cases, neither the vehicle nor the material is paranormal.
> (5) Something which may be broadly called a subconscious *motive* underlies the formation of mediating vehicles in normal and paranormal cases alike...(Tyrrell, 1947, p.117).

L.E. Rhine (1962, 1967) then elaborated upon Tyrrell's model by examining large collections of 'spontaneous cases' (that is, 'real life' experiences rather than lab. experiments) of ostensible ESP, to see what 'mediating vehicles' were used. She found that psi experiences fell into four different forms: intuitions, hallucinations, and realistic and unrealistic dreams, and concluded that these must be the 'psychological means' by which information transferred from Stage 1 (unconsciousness) to Stage 2 (consciousness). In her popular book *ESP in Life and Lab*, Rhine (1967) conveyed the same basic message as Tyrrell had, though in a different language:

> In the workshop of the unconscious the several forms in which ESP information can be processed are available to carry it to higher levels. But they are not objects like carts or cars standing around waiting to be loaded. They are processes ready to be activated, for although the messages arrive at their destination without a tag or any obvious indication of their source, they are not simply "there", instantaneous, pristine, and unchanged from start to finish. They do not come like a streak of lightning, clear, immutable, or not at all.
>
> They are the result of processes that operate in the secret recesses of the mind and cannot be directly observed. They do go on long enough, and in such a manner, however, that circumstantial evidence can show something of the way they operate. (Rhine, 1967, p.178).

These ideas, therefore, provide a theoretical foundation upon which studies comparing subliminal and extrasensory perception may rest.

Comparing subliminal and extrasensory perception. For detailed consideration of the similarities that have been identified between subliminal and extrasensory perception, the following papers are recommended: Beloff, 1974; Dixon, 1979; Irwin, 1979; Johnson, 1975; Nash, 1986; Rao & Rao, 1982; Roney-Dougal, 1981, 1986; and Schmeidler, 1986, 1988. As an example, however, let us consider individual differences in what might loosely be termed 'cognitive styles'. Experimental findings both in parapsychology and subliminal perception indicate that there are wide individual differences in apparent 'sensitivity' to subliminal and extrasensory stimulation. It seems that authors generally take an operational definition of 'sensitivity' - for example, sensitivity is revealed in the correct identification of subliminal stimuli observed in an experimental task. Often, theoretical assumptions as to what 'stage' of perception or cognition is indicated by task scores are not made explicit (and one wonders sometimes whether such assumptions have even been considered implicitly). While terms such as 'sensitivity' may imply fairly basic sensory or perceptual processes, in fact authors often correlate 'sensitivity' scores with 'higher level' cognitive, personality, and situational variables.

1. *Subliminal perception*. Eagle (1962) studied the personality correlates of individual differences in sensitivity to subliminal stimulation. Each subject took part in a subliminal perception task, and the scores were rated according to the subject's sensitivity (indicated by the degree to which interpretation of a supraliminal stimulus was influenced by a previously-presented subliminal stimulus). Participants were also given an extensive battery of psychological tests. It was found that when subjects were split into 'high' and 'low' sensitive groups, each group showed distinctive 'cognitive styles'. High sensitivity was characterised by being responsive to people, intuitive, strong in imagery, confident, and with cognitive and affective openness. In contrast, subjects who were low on sensitivity to subliminal perception scored low on these characteristics. Similarly, in her review of the literature on the effect of personality variables on subliminal perception (which did not include the study by Eagle), Roney-Dougal (1986) concluded that 'those susceptible to subliminal stimuli tend to show less repressiveness, more imageability, more 'passivity', greater flexibility of report, and less hostility' (p.416). A state of dispersed attention or relaxation is known to facilitate sensitivity to subliminal stimulation (Dixon, 1981; Fiss, 1961; Fisher & Paul, 1959). Such a relaxed state may be achieved through pharmacological means, by

instructing subjects in relaxation, or by pre-selecting subjects who exhibit such characteristics.

2. *Extrasensory perception.* There are several parallels between the above-noted cognitive and personality variables thought to enhance receptivity to subliminal stimulation and those thought to facilitate psi perception. Parapsychologist Gertrude Schmeidler (1986) was struck by the similarity between Eagle's (1962) personality correlates and those which had been noted by researchers attempting to characterise the individual differences in personality between psi-hitters and psi-missers. William Braud has proposed a 'psi-conducive syndrome' of characteristics appearing to facilitate manifestations of psi (Braud, 1975). Among these is a tendency to have decreased egocentricity and a concomitant increase in caring for others.

Another apparently psi-conducive characteristic is to have an increased awareness of internal processes, feelings, and imagery (Honorton, 1974). Braud gives anecdotal and experimental evidence supporting his speculation that 'receptive mode/right hemispheric functioning' may facilitate psi. He concludes that this mode of processing is characterised by 'a more passive acceptance of appreciation; diffuse attending; paralogical thought processes; decreased boundary perception; dominance of the sensory over the fomal; and imagery, spatial, concrete, holistic, nonlineal, analogical, intuitive, and unconscious functioning' (p.147). Relaxation has also been found to enhance psi performance (perhaps not surprisingly, since a state of relaxation would be expected to facilitate a more passive, open, and non-analytical state of mind)(Braud & Braud, 1974).

One area of parapsychological research that has arisen from the assumption that common processes may affect subliminal and extrasensory perceptions concerns reactions to unconsciously-perceived unpleasant or threatening information. As stated by Martin Johnson, one of the first to conduct systematic research in this area:

> People who are prone to draw their preconscious blinds in matters of visual perception might act somehow similarly towards perceptions which are extrasensory. (Carpenter, 1965, pp.70-71)

Subsequently, a series of experiments have demonstrated a relationship between 'defensiveness', broadly defined as unconscious resistance to unpleasant or threatening information, and 'psi' performance (defined below) (e.g. Haraldsson & Houtkooper, 1992). This thesis is concerned with the defensiveness-psi relationship and, ultimately, with what this relationship can tell us about how psi works. In discussing the value for parapsychology of research of this nature, Rao (1978) notes:

> The recognition that psi usually operates at the level of the unconscious raises the possibility that an understanding of the dynamics of the unconscious may give us insights into the way psi manifests in our consciousness. (pp. 266-267).

By exploring individual differences in cognition, personality, attitudes and motivation, parapsychologists can learn more about the psi process, and this thesis is intended to make a contribution to that effort. Before proceeding, however, it is necessary to clarify the meaning of some terms which will be used frequently, and to set a context for the research which follows.

It is useful at the outset to distinguish between 'proof-oriented' and 'process-oriented' research in parapsychology. The principal aim of the former is to prove that 'psi' exists, while the latter is more concerned to find out how psi works. Based on the premise that one can never prove anything beyond doubt, most parapsychologists prefer to accept the existence of psi as a working hypothesis. Their research efforts therefore tend to focus on identifying correlates of psi performance and testing process-related hypotheses that may lead to the construction of theories of psi. For a more extensive consideration of theoretical conceptualisations of psi, see Stanford (1977, 1992). This thesis continues the process-oriented tradition.

Definitions

'Parapsychology' is the scientific study of apparently anomalous means of communication between an organism and its environment. The words 'apparently anomalous' refer to occasions where information appears to have been exchanged between an organism and its environment despite the fact that known channels of communication and inference are closed. For example, if a person (the 'receiver') in one sensorially isolated room can correctly describe a picture (the 'target') which is being seen by another person (the 'sender') in a second sensorially isolated room, such that there is no possibility for even the slightest cues of sight, sound, smell, and so on, to be transmitted from the sender to the receiver, and there is no way that the receiver could have prior knowledge of, or could infer, the target identity, this might be considered to be apparently anomalous communication. (Of course the receiver could correctly describe the target by chance alone, so any single instance of apparently anomalous communication is uninformative. With repetition, however, one can establish a theoretical chance baseline for correct target identification and one can statistically compare the obtained correct target identifications with the number which would be expected by chance. One may thereby examine whether an experiment, or group of experiments, supports the hypothesis of anomalous communication.)

The use of the term 'anomalous' does not, however, entail any presumption that the communication is somehow non-physical, defying the 'laws of physics'. It is quite possible that the information is travelling along channels obeying physical laws which have yet to be discovered. That this communication is described as 'apparently' anomalous acknowledges, too, that information may be 'leaking' along channels which parapsychologists have as yet failed to recognise or monitor.

The somewhat multi-purpose term 'psi' is applied to situations where such anomalous information transfer may be occurring. Hence, a 'psi task' refers to an experiment designed to prevent information transfer along known channels of communication or inference, that may enable one to infer that some sort of 'anomalous' information transfer has nevertheless taken place. 'Psi-missing' and 'psi-hitting' describe, respectively, consistent scoring below or above mean chance expectation in a psi task.

Psi is a general term, and parapsychologists usually distinguish between two types of anomalous communication. The first of these, 'Extrasensory Perception' (ESP), refers to cases where the organism gains information from its environment, either from the experience of another organism ('Telepathy'), or without the conscious mediation of another organism ('Clairvoyance'); when this information does not exist in the present, but is located in the future, this is termed 'Precognition'. 'Psychokinesis' (PK) is the second class of psi phenomena, referring to cases where the environment appears to be receiving information or influence from the organism; in other words, the organism is exerting some influence over the environment (PK is also popularly known as 'mind over matter').

It is actually extremely difficult to distinguish, at a theoretical level, between these different categories of psi. For instance, if a subject is asked to generate impressions of a picture which is concealed in an envelope, this would be described to the subject as a clairvoyance task. But if one accepts the possibility of precognition then perhaps the subject is gaining impressions of the target not in 'real time' but by looking to the future moment of feedback, when the picture is revealed. One might never give the subject feedback of the target identity, but what if someone else opens the envelope in the future - could the subject precognitively read their minds? Also, how did the picture get in the envelope in the first place? Someone must have put it there, so the subject could read their minds in 'real time' rather than clairvoyantly gaining impressions directly from the sealed envelope.

Parapsychologists have of course grappled with these questions, and procedures have been evolved to attempt to test for 'pure' clairvoyance, precognition, and PK (e.g., Rhine & Pratt., 1957), but at present the simplest solution is to define telepathy, clairvoyance, precognition, and PK, in operational terms: that is, how the experimental task is presented to the subject will establish their direction of attention and intention (that is, it will frame the task for them). A telepathy task would ask the participant to work with a 'sender'; a clairvoyance task would have no sender; a precognition task would ask the subject to identify the nature of a target to be selected in the future; and a PK task would ask the participant to try to influence the target.

ESP experiments usually present participants with either or both of two general forms of task: forced choice or free response. A forced choice ESP task is one that presents participants with a known, restricted range of target possibilities; an example would be the 'Zener' cards, showing just five simple geometric shapes, that were used in the early days of experimental parapsychology. Participants are required to choose correctly which of the five cards is the designated target. The number of correct guesses ('hits') that would be expected by chance alone is compared with the actual number of hits and if the actual number of hits deviates significantly from chance expectation then this is thought to indicate that some sort of anomalous information transfer has occurred (assuming known channels of communication and inference have been ruled out).

A free-response ESP task, as the name suggests, is one that has a potentially infinite range of target possibilities: from video clips of nature programmes, movies, and old newsreels; to static pictures clipped from magazines, or postcards of works of art; to geographical locations; to real, three-dimensional objects which a 'sender' may be able to touch and handle. Usually, in any one experiment only one type of free-response target is used, but this still allows a wide range of possible targets. The participant responds to the target by generating thoughts, feelings, and images, that are noted or recorded in some way; this 'mentation' is then compared to a duplicate of the actual target, presented alongside several 'foils'. The degree of similarity of the mentation to the 'target pool' may be judged by the participants themselves, or by independent raters. The member of the target pool which is judged to be most similar to the mentation is chosen as the target. From this point on the scoring is quite similar to that for forced choice targets: the number of correct target judgements is compared to chance expectation (see Morris, 1978, and Edge, Morris, Palmer, & Rush, 1986, for more detailed descriptions of experimental and statistical methods in parapsychology).

Unlike the forced choice methodology, free response scoring systems may enable analyses of the *degree* of correspondence between the mentation and the target pool members. The main difference between forced choice and free response methodologies is that the latter provides qualitatively richer material which may give greater insight into the ESP *process* than the former. An associated drawback is that whereas the occurrence of a hit is unambiguous with forced choice methods, the rich free-response material may include 'noise' that is unrelated to the target, or that may be related by chance to another member of the target pool, so there is more ambiguity in identifying a hit with the latter methodology.

Perhaps the most successful free-response methodology, which has already been referred to briefly, is called the 'ganzfeld'. In the ganzfeld, the participant relaxes in a pleasant state of partial sensory deprivation induced by unpatterned auditory and visual stimulation (visually, the participant usually experiences a uniform grey or pink 'screen' that encompasses the entire visual field, so that not even the nose is seen; headphones playing 'white noise' at a comfortably loud level provide unpatterned auditory stimulation). The state of consciousness induced by the ganzfeld stimulation is thought to be conducive to ESP, by dampening down external and internal sources of distraction or 'noise', and encouraging the experience of internal mental imagery (Honorton & Harper, 1974; Braud, 1975). The expectation is that this internal mental imagery is related to the target which is simultaneously being presented in a second, remote and sensorially isolated room (the ganzfeld may also be used with a precognitive design, but the 'real time' method is most common).

A 'Subliminal Perception' task is one where a stimulus is presented to an individual in difficult perceptual circumstances (see Dixon, 1971, & 1981, for a comprehensive introduction to the techniques and findings of research in subliminal perception; Merikle & Cheesman, 1987, present a brief summary of the current status of research in subliminal perception). Although the term *subliminal perception* may be outmoded nowadays (see chapter 2), it will be used thoughout this thesis because its similarity with the term *extrasensory perception* suggests an overlap between the two phenomena that is a basic premise of this thesis. In a subliminal perception task, the stimulus may be briefly presented (e.g., illuminated for only a few milliseconds), or of weak physical intensity (e.g. presented at very low levels of illumination), such that the individual claims to be unaware of the stimulus, despite having apparently perceived and responded to it. Note that this is a subjective definition of awareness, resting on the reported perceptual experiences of the subject (e.g. Merikle, 1984). Chapter 3 includes further discussion on the controversial matter of what constitutes awareness.

Whereas subliminal perception experiments attempt to present stimuli below levels of awareness, investigations of 'Perceptual Defence/Perceptual Vigilance' are more concerned with the grey 'threshold' area where individuals begin to become aware of the stimulus (Bruner & Postman, 1946, 1947; Brown, 1961; Dixon, 1981). These studies typically attempt to measure thresholds for subliminally presented neutral stimuli and then observe how thresholds alter for subliminally presented emotional stimuli. Where a person's threshold for emotional stimuli seems higher than for neutral stimuli (that is, the presence of an emotional stimulus is reported less quickly than that of a neutral stimulus), this is termed perceptual defence. Conversely, an individual is described as perceptually vigilant if the subliminally presented emotional stimulus is reported more quickly than a neutral stimulus.

Researchers into perceptual defence/vigilance typically use one of two variables as the threshold measure, both of which are subjective in nature. The 'awareness threshold' is the stimulus duration or intensity at which the subject claims to notice the presence of the stimulus. The 'recognition threshold' refers to the stimulus duration or intensity at which the subject is able to identify the stimulus (Dixon, 1981). For instance, if a subliminal stimulus is a written word projected onto a screen at a gradually increasing brightness, the awareness threshold would be signified by the point at which the subject reports noticing the presence of the stimulus (e.g., a patch of light, or a shape), without being able to identify it; the recognition threshold would be the first point at which the subject could identify the word.

Defensiveness and neuroticism. The term 'defensive' is often popularly used to refer to an individual who withdraws from, or is resistant to, unpleasant, stressful or threatening information. Perceptual defence and perceptual vigilance *can* be constructively regarded as different strategies of coping with stressful information (Olff, 1991), but it is more usual to find that perceptual defensiveness is, either implicitly or explicitly, regarded as a maladaptive response to stress (e.g. Cooper, 1988a; Henley & Dixon, 1976; Vaernes, 1982). How is the concept of defensiveness related to personality styles?

The phenomenon of perceptual defence (that is, the apparent raising of perceptual thresholds for emotional compared to neutral stimuli) has been considered to be analogous to the Freudian concept of repression (that is, the denial of entry into consciousness) (Kline, 1981; Cooper, 1982; Cooper & Kline, 1986). For example, Kline (1981) argues that:

> Since in Freudian theory...repression is defined as denial of entry into consciousness, it can be seen that perceptual defence...is precisely the same. The raising of the perceptual threshold to the emotionally loaded stimulus word is simply an example of repression at work...That perceptual defence...is an example of repression is fully supported by Fenichel (1945) who makes it clear that the defence mechanism applies to external perceptions of the real world and not just to mental events (pp. 210-211)

Weinberger, Schwartz, & Davidson (1979) define repression as 'low anxiety, high defensiveness', so there appears to be some agreement that, at least in theory, perceptual defence and repression may be related concepts; both certainly concern the denial of entry of potentially stressful information into consciousness.

Turning now to the relationship betwen defensiveness and neuroticism, Kreitler & Kreitler (1990) note that 'more theoretically oriented discussions of repression emphasize favorably its status as a major element of a *neurotic* personality style' (p.559). It appears to me, however, that there has as yet been little *experimental* demonstration of the relationships between perceptual defence and repression, and between these and neuroticism. Cooper & Kline (1986), for instance, found no relationship between scores on the repression scale of the Defence Mechanism Test (DMT - a projective psychological test that will be described in detail in the following chapter, which is designed to elicit and measure the operation of various Freudian defence mechanisms) and a measure of perceptual defence. Similarly, Haraldsson & Houtkooper (1992) reported a series of studies with the DMT that had found no relationship between DMT scores and other major personality factors.

However, a number of studies have recently been carried out to develop and validate the NEO-PI (a personality questionnaire based on a five factor model of personality, measuring neuroticism, extraversion, openness, agreeableness, and conscientiousness), and some of these have correlated neuroticism with coping mechanisms such as defensiveness. Details of these validation studies are reported in the NEO-PI-R Manual (Costa & McCrae, 1992). One finding was that 'many theoretically immature or neurotic coping mechanisms...were significantly related to NEO-PI N (neuroticism) scores...poor coping is intimately tied to this domain' (Costa & McCrae, 1992, p.51, my brackets). For instance, in the two studies reported by McCrae & Costa (1986), it was found that: 'In both studies, neuroticism is associated with increased use of hostile reaction, escapist fantasy, self-blame, sedation, withdrawal, wishful thinking, passivity, and indecisiveness' (p.392). Also, a study by Costa, Zonderman, & McCrae (1991) that correlated 292 participants' Neuroticism scores with three sets of measures of defence mechanisms (Bond, Gardner, Christian, & Sigal, 1983; Haan, 1965; Ihilevich & Gleser, 1986) found that:

> N was related to measures of regression, displacement, doubt, and maladaptive action patterns, confirming the association of N with poor coping styles...(and showing that)...individuals' characteristic ways of dealing with stress and conflict are consistent with their enduring personality traits (Costa & McCrae, 1992, p.52, my brackets).

In summary, then, neuroticism may be linked to perceptual defensiveness on a theoretical level, and there is some experimental research that also indirectly suggests a possible relationship between perceptual defensiveness and neuroticism, if one accepts that coping and defence mechanisms are related to perceptual defensiveness. The experiments in this thesis may enable a more direct comparison between perceptual defensiveness and neuroticism.

Outline of Thesis

One of the problems facing parapsychology is that psi effects are apparently weak and unreliable (Shapin & Coly, 1984; Rush, 1986). The use of meta-analytic techniques has helped to identify both the size of psi effects and some of the factors associated with enhanced psi performance (e.g. Honorton et al., 1990; Honorton, Ferrari, & Bem, 1991; Utts, 1991; Radin & Ferrari, 1991). Meta-analysis can therefore help to identify potentially fruitful lines of research. This thesis reviews studies suggesting a relationship between 'defensiveness' and psi performance, and reports the outcome of a new meta-analysis of a subset of these studies, that used the Defence Mechanism Test (DMT) as a measure of defensiveness. The review and meta-analysis suggest that there is a need for independent replication of the defensiveness-psi findings. Difficulties with the various methods used for measuring defensiveness are identified, and the development of an alternative, prototype measure of 'perceptual defence/vigilance', using a 'subliminal perception' paradigm, is described. Seven experiments are reported. Their aim is to develop this prototype indicator of perceptual defence/vigilance, to provide a conceptual replication of the 'DMT-ESP studies', and to explore the process-related questions of how the personality of the experimental participant and the nature of the ESP target correlate with psi performance.

After summarising and synthesising the findings of these experiments, the thesis concludes with some suggestions for future research.

Chapter 2. The defensiveness-psi correlation.

General Introduction and Review

In their attempts to identify correlates of successful psi performance, and ultimately to understand how psi works, parapsychologists have related various measures of personality and cognitive style to ESP performance. For example, extraversion has been shown to correlate with ESP, the more extraverted tending to score more highly at ESP tasks (e.g. Honorton, Ferrari, & Bem, 1991). Two explanations have been put forward for this trend: 1. extraverts are more sociable than introverts and hence more comfortable in an experimental setting; and (not necessarily mutually exclusive), 2. extraverts tend to have lower levels of cortical arousal than introverts, and so would have the reduced physiological arousal that is thought to be psi-conducive (Braud, 1975). Also on the question of arousal, Stanford has explored the relation between extraversion/introversion, the intensity of white noise stimulation in the ganzfeld, and ESP performance. He found that extraverts enjoyed the relatively loud white noise stimulation and had higher ESP scores than introverts (Stanford et al., 1989a, 1989b). However these findings were not replicated in a study by Stanford & Frank, 1992. As chapter 1 pointed out, one topic that has excited much interest is the study of unconscious reactions to weak stimuli, of both subliminal and extrasensory origin, especially with relation to defensiveness.

The most systematic exploration of the defensiveness-psi relationship has used the Defence Mechanism Test (DMT) as the measure of defensiveness, and the bulk of this chapter will deal with a review and meta-analysis of the

DMT-ESP studies. Besides these studies, a number of others have correlated some measure of defensiveness with psi performance. As will be seen, these measures tend to assume different definitions of defensiveness; nevertheless they show some consistency in their relationship to psi performance.

Behind all the studies that have explored the defensiveness-psi relationship is the assumption that there exist considerable commonalties between individuals' characteristic responses to weak stimuli, whether they be of subliminal or extrasensory origin; the quotes in chapter 1 from Tyrrell (1947), Carpenter (1965), J.B. Rhine (1977), L.E. Rhine (1967), and Rao (1978) exemplify this approach. The defensiveness-psi studies therefore sought to explore the relationship between the subliminal and the extrasensory with particular reference to resistance to weak, possibly negatively emotional, stimuli. It had been noted (by, for instance, Roney-Dougal, 1987; Carpenter, 1965), especially, that defensiveness to weak or subliminal stimuli appeared strongly similar to the phenomenon of psi-missing (consistent scoring *below* chance expectation at a psi task, that suggests the participant knows the target identity, but is *avoiding* correctly identifying the target, possibly for attitudinal, motivational, or emotional reasons). Beloff (1974) points out:

> The acknowledgement of perceptual defence as a genuine psychological phenomenon should make it that much easier for us to accept the concept of 'psi-missing' as a parapsychological phenomenon. For the point about perceptual defence is that it implies the possibility of identifying a stimulus at an unconscious level in order to prevent its recognition at a conscious level (p.109)

Before reviewing the DMT-ESP studies, I will briefly overview other defensiveness-psi research. A series of studies by Lendell Williams Braud

(Braud, 1976; Braud, 1977; Williams & Duke, 1980) found 'openness versus closedness' related to ESP performance. An 88-item questionnaire composed of four principal scales was developed, including items from Jourard's Self-Disclosure Inventory (Jourard,1971) (Jourard equated the healthy personality with a nondefensive, open, and self-disclosing attitude; Jourard, 1974). The term 'openness' was used very broadly to refer to 'the opening up and taking in of experiences...and...the opening up and letting out, or self-disclosure, of aspects of ourselves' (Braud, 1976, p.155). One of the scales was specifically aimed at identifying 'defensiveness' in individuals. Braud therefore conceptualised 'openness' or 'nondefensiveness' very broadly, including tolerance to a variety of attitudes, nonsuspiciousness, accepting of unusual experiences and altered states of consciousness, and accepting of oneself, including a willingness to disclose aspects of oneself. This is a relatively loose definition of defensiveness, compared to that found, for instance, with perceptual defensiveness in the subliminal perception paradigm. Nevertheless, these different conceptualisations of defensiveness may share some common ground since they both relate to resistance to or distortion of some aspects of reality. These studies used free-response ESP methodology, and generally all found the same trend towards more psi hitting from more 'open' subjects.

Another study, by Miller & York (1976), designed a projective test 'similar to the DMT' as a predictor of performance at a free-response clairvoyance test. The projective test presented subjects tachistoscopically with six stimulus pictures on slides; three of the slides showed a central hero figure and a peripheral threatening figure, while three control slides showed a central hero figure but no threat. The slides were shown to participants at gradually increasing exposures and participants described what they could see at each exposure, until they gave accurate descriptions of the slide contents. If participants took considerably longer to report the peripheral threat figure than the central hero figure, this was regarded as 'perceptual filtering or screening'. The analysis compared the psi performance of 'high perceptual filterers' (i.e., high defensive) with 'low perceptual filterers' (i.e., low defensive); results were in the predicted direction (lower psi scores for the high perceptual filterers), but not significantly so.

Johnson & Lübke (1977) cite this study by Miller & York and the studies by Williams Braud as providing indirect support for the DMT-ESP relationship to be described shortly; while the methodologies are not directly comparable, there is a common trend for those participants who tend to distort or resist potentially threatening stimuli to score relatively poorly at psi tasks.

Bellis & Morris (1980) supplemented the 88-item openness questionnaire with three items measuring belief in ESP, and gave subjects a free-response clairvoyance task. They considered that their results suggested a weak but positive relationship between openness and psi. A subsequent study (Sondow, Braud, & Barker, 1982) used a 22-item openness questionnaire and found no significant difference between psi-hitters and psi-missers on questionnaire scores. However, the entire sample consisted of low-defensive subjects. (Unfortunately, one cannot tell from the data reported in Sondow, Braud & Barker whether or not the openness-psi relationship was in the predicted direction, although it was not statistically significant).

Sondow (1987) measured subjects' hypnotizability and creativity in order to explore the assumption that:

> psi information first enters at an unconscious level; thus, openness to the unconscious should aid in the psi task, while personalities that habitually censor, repress, or inhibit unmodified unconscious material might also habitually repress intrusions of psi information into consciousness (p.42)

Subjects also participated in a free-response ganzfeld experiment. Dream quality correlated significantly with psi success (r_p=+.25, 58*df*, p<.05, 2-t), suggesting to Sondow that 'of the measures planned to reflect lack of repression, the best seems to have been the dream quality score' (p.45), as reports of bizarre and unrealistic dreams might be thought to indicate low repression or defensiveness.

'Openness' was also found to relate to psi performance (and subliminal perception performance) by Roney-Dougal (1982). She described an exploratory and a follow-up study that gave subjects a battery of tests including a measurement of their attitudes towards subliminal and extrasensory perception, and their openness as measured by the Ås Openness-to-Experience questionnaire (which was originally designed to measure susceptibility to hypnosis; Ås, O'Hara, & Munger, 1962). Subjects' performance on subliminal perception and ESP tasks correlated in the predicted direction (though not always to a statistically significant degree) with their personality and attitude test results. Roney-Dougal concluded that 'overall hitting ability, irrespective of the nature of the information [subliminal or extrasensory], is clearly related to attitude and to one's openness to experience of altered states of consciousness' (Roney-Dougal, 1982, p.99, brackets mine).

Finally, a rather unusual performance measure of defensiveness was suggested by Stanford & Schroeter (1978), who expected persons with low levels of defensiveness more readily to express impulses mediating extrasensory responses. The ESP measure was a word association task, and defensiveness was measured by the degree to which subjects chose to recline the chair for their ESP task. It was assumed that low defensive individuals might choose the fully reclined position, while high defensive individuals might feel more vulnerable, threatened and less able to relax in such a position and should therefore choose a more upright seating posture. Out of 67 subjects, 40 chose the fully reclined position while 27 adjusted the chair to be either partially reclined or upright. The 'laid back' group of subjects scored significantly greater than chance at the ESP task (t=2.1, 39*df*, p=.04, 2-t). The remaining group scored non-significantly below mean chance expectation. The difference in ESP scoring between the two groups was in the anticipated direction, but not significantly so. This 'chair test' of defensiveness in a psi task seems to have been discovered independently of an earlier study in subliminal perception by Fisher & Paul (1959). Subjects were subliminally stimulated and then asked to draw images either in an upright position with the room illuminated, or in a supine position with the room darkened. The latter group showed the stronger subliminal effect, however in this study the effects of seating position are confounded with those of lighting conditions.

In conclusion, if one takes a broad definition of defensiveness as a tendency to resist or distort weak or subliminal potentially stressful information, it can be seen that researchers using a variety of different indicators and conceptualisations of defensiveness have found a general trend for relatively high defensiveness to be associated with relatively poor ESP performance, and conversely for relatively low defensiveness to be associated with relatively successful ESP performance. None of these various indicators of defensiveness has been applied in a systematic way, however; it is to the studies comparing ESP performance with scoring on the Defence Mechanism Test that one must turn for a more rigorous examination of the defensiveness-psi relationship.

Review and Meta-Analysis of the DMT-ESP Studies

Introduction to the Defence Mechanism Test: Application, methodology, theory, and validity.

Application of the DMT. The DMT was developed in Sweden by Ulf Kragh (1955) primarily for use in the Swedish air force to predict the ability of pilots to cope with life-threatening stressors, and to select out those pilots who were likely to be 'accident prone'. With governmental support, Kragh was able to carry out extensive validation tests of the DMT, and Neuman (1978, cited in Cooper & Kline, 1986) found the DMT could indeed identify those pilots who were likely to be involved in accidents, and that after pilots had either passed or failed their training the DMT was the only psychological instrument that retained its predictive power. Nowadays the DMT is primarily used in Swedish and other NATO air forces as an instrument for selection of air force pilots, though it has also been used to identify those who are likely not to perform well in other dangerous and stressful tasks, such as deep sea diving and parachuting (Vaernes, 1982; Vaernes & Darragh, 1982; Cooper 1988a).

Method. The DMT is a projective test (that is, one that presents participants with ambiguous information or an unstructured task on the assumption that participants' perception and interpretation of the test material may reflect their characteristic thought processes, motivations, anxieties, and conflicts). In what is probably the most up-to-date comprehensive survey of the use of the

DMT in Europe, Olff (1991) noted that there was a wide variation among researchers in the DMT methodology they used, including differences in apparatus (e.g. whether stimuli were presented within a tachistoscope viewing box or were projected onto a screen), stimulus pictures, number of stimulus exposures, instructions, subject's response mode (e.g. written and/or verbal), evaluation of the protocol, and analysis. Based on her survey, Olff made a number of recommendations for standardising DMT methodology. For the present thesis, which considers the use of the DMT in parapsychology, it is most helpful to describe the DMT methodology as parapsychologists have typically applied it (though even in this small subset of DMT studies there are variations in testing).

Subjects are repeatedly exposed to (usually) two pictorial stimuli similar to Thematic Apperception Test cards as well as a 'distractor' picture that is not evaluated. In order to increase the reliability of the test, the stimulus pictures are presented in two parallel series (that is, alternating presentations of each picture), with the distractor picture being exposed before each stimulus picture exposure.

The stimulus pictures usually depict a central 'hero' figure and a peripheral 'threat' figure; both figures are of the same sex as the subject, and the threat figure is usually judged to be older than the hero figure. The distractor picture can vary; in the two studies reported by Johnson & Kanthamani (1967), for instance, the distractor depicted two 'fighting boys'. The purpose of the distractor picture is to familiarise subjects with the procedure and to ensure that they have similar expectations about the appearance of the stimulus slides proper. Olff (1991) notes, however, that the nature of the distractor picture is quite important in the cognitive set, and consequent expectancies, that it may elucidate in subjects; many of the DMT studies reviewed by her used non-aggressive distractors that might predispose participants to react differently to the stimulus slides than aggressive distractors.

Initial exposures are very brief (around 8 milliseconds) and exposure times gradually lengthen through a series of increments up to around 2 seconds. When subjects are tested individually, the stimuli are usually presented via a tachistoscope; when tested in groups (of about 6 to 8 persons), a slide projector with a camera shutter may be used. Background luminance is measured and held constant. The brief exposures mean that the stimuli appear unclear. After each exposure subjects are required to try to describe, in writing and drawings, what they thought was presented. The test continues until subjects correctly identify the main elements of the stimulus pictures.

Trained scorers examine each of the series of subject's descriptions and score each protocol according to the presence or absence of one or more of the ten defensive 'signs' which, theoretically, correspond to Freudian and neo-Freudian defence mechanisms: repression (often considered analogous to perceptual defence, e.g. Dixon, 1981; Wagstaff, 1974a), isolation, denial, reaction formation, identification with the aggressor, turning against the self, introjection of opposite sex, polymorphous introjection, projection and regression.

Theoretical assumptions underlying the DMT. Typically, the stimuli feature a central 'hero' figure with an older more threatening and unpleasant 'threat' or 'secondary' figure seeming to emerge from the shadows behind the hero. Kragh used the assumptions of projective test theory to argue that the secondary figure induces unconscious anxiety in the subject: through projection, the subject identifies with the hero figure and therefore the apparent threat against the hero from the secondary figure evokes defensive reactions in the subject. The fragmented nature of the stimuli supposedly allows the subjects to project their characteristic Freudian defence mechanisms into their description of what was seen. So, distortions in subjects' descriptions of what they see are thought to reveal the operation of Freudian defence mechanisms. The subject is not aware that the stimulus is actually the same each time; changes in what the subject describes seeing over the series of exposures, plus the distractor picture, apparently lead most subjects to conclude that there are subtle differences between each picture exposed.

The technique of presenting the stimulus picture serially and in increasingly lengthy steps is based on the principle known as percept-genetics (Kragh & Smith, 1970; Smith & Westerlundh, 1980). This theory suggests that perception is a constructive or an adaptive process, and that it is possible to examine this process by disrupting or 'fractionating' perception through presenting the stimulus very briefly and serially. It is thought that some of the perceptual distortions which occur during the fractionating process may indicate the operation of defence mechanisms. At very brief ('stimulus distal') exposures, the stimulus is highly ambiguous and the subject's perception of it is thought to be dominated by internal, personality factors. At longer ('stimulus proximal') exposures the stimulus becomes increasingly clear and early perceptions are modified until a completely accurate description of the stimulus is given.

The DMT therefore has three basic theoretical assumptions: that through projection the subject identifies with the hero figure; that the presence of the secondary figure activates Freudian or neo-Freudian defences; and that by fractionating perception these defences can be studied and scored. However, it is not necessary for the individual researcher to accept these assumptions, as the DMT uses them more as working hypotheses, to be tested and rejected as necessary (Cooper, 1982) (a brief description of such a test is given in the following section on validity of the DMT).

Validity of the DMT. We have seen that the DMT appears to have some external validity in predicting individuals' ability to cope with stress and threat. It is not yet clear, however, that the success of the DMT validates the existence of percept-genetic processes and/or Freudian defence mechanisms. A one-time student and colleague of Ulf Kragh, Martin Johnson, introduced the DMT to parapsychology; Johnson has argued that the success of the DMT does not validate percept-genetic ideas because there has been no attempt to test these assumptions explicitly. He implies that those researchers who have considered the DMT truly to demonstrate percept-genetic mechanisms have tended to validate their own expectations: by selective reporting; by not stating their expectations in advance; and by not carrying out validation 'blindly' (Johnson, 1986).

However, formal studies to validate the DMT *have* been conducted (e.g. Kragh, 1962; Cooper, 1982; Cooper & Kline, 1986; Kline, 1987; Cooper, 1988b; Kline, 1988a). Kragh (1962), for instance, adminstered the DMT with both threatening and smiling secondary figures to examine the effects of these different stimuli on 'percept-genetic defensive organisation'. He found significantly more signs of defensiveness in the protocols of subjects who saw the threatening secondary; however some of those who saw the smiling secondary also showed some signs of defensiveness. Kragh concluded that while the subliminal threat seemed important for the activation of defences, he could not rule out the possibility that stimulus ambiguity alone could also be effective. A similar study, by Cooper & Kline (1986), administered the DMT with both threatening and neutral secondary figures, to test whether there was more evidence of perceptual distortion (perhaps indicating the operation of defence mechanisms) for the former stimuli than for the latter; they concluded that 'the nature of the Secondary figure exerts a powerful influence on the number and nature of the defences coded...A threatening Secondary induces a higher level of defensive activity' (p.25).

These results support but do not confirm the assumption that identification with the hero figure activates defences. Perhaps it is simply the negative emotional tone associated with the traditional DMT stimulus that induces stress and perceptual distortions. As Cooper (1982) states:

> it would seem useful to examine whether or not even more dramatic results may be obtained when the 'hero/secondary' notion is abandoned in favour of a purely aversive stimulus...Subjectively...it did seem that more dramatic distortions were observed to Picture 8BM of the TAT, which depicts a rather primitive surgical operation, than to the more traditional 'ugly face' threat (Cooper, 1982, p.286).

Similar thoughts were voiced by Johnson & Carpenter in the first study to compare DMT and ESP performance (Carpenter, 1965) (discussed in more detail below). Noting that a correlation had been found between relatively neutral ESP target material and defensiveness, they asked:

> If the ESP targets were constructed out of threatening figures rather than geometric designs, would the effect be stronger? (p.73)

Cooper argued that a general weakness of the DMT was that the operation of defence mechanisms was inferred rather than directly observed. Clinical studies have shown the DMT to be useful in the differential diagnosis of alcoholism, parent loss, and phobias (Kragh & Smith, 1970). For instance, Kragh & Kroon (1970) compared the frequency of reported aggression in DMT protocols for a group of young offenders (at reform schools) and a contol group. It was found that at relatively brief exposure levels (hypothesised to reflect early stages of perceptual development) there was no difference between the two groups in the amount of reported aggression. At longer exposure levels (hypothesised to reflect later stages of perceptual development), the young offenders' DMT protocols contained significantly less aggressive content than did the protocols of the control group. This latter finding suggested to the authors that the young offenders' defensive structures (such as repression, isolation, and reaction formation) were activated at longer exposure levels. While such studies do not directly prove that the DMT is measuring defence mechanisms (for instance, perhaps the young offenders had learned at their reform schools not to vocalise their feelings of aggression), they do show the test's potential applicability in practical settings.

Kline (1987) argued that, although the various signs of defensiveness were derived from psychoanalytic studies of individuals in a clinical setting, these have face validity only. For example, the defence mechanism of Isolation is coded when 'the hero and secondary figure are separated or isolated; one may not be seen'; for Denial, 'the threat is emphatically denied' (Kline, 1987, p.55). Just because a part of a DMT protocol resembles a defence mechanism, this does not confirm that the individual's responses actually reflect the operation of Freudian processes. Cooper & Kline (1986) found some indications that responses to the DMT were as hypothesised from Freudian theory, but they also found little correspondence between the repression scale of the DMT and Wallace & Worthington's (1970) measure of perceptual defence (described in more detail in chapter 3, this test measured subjects' rate of dark adaptation to projections of taboo and matched control words; relatively slow dark adaptation to taboo words was thought to indicate perceptual defence).

Whether or not the stimulus exposures in the DMT are subliminal is open to debate, and depends upon one's definition of subliminal (see the discussion on this topic in chapter 3). Certainly at later, more lengthy, exposures, subjects see increasingly detailed glimpses of the stimulus pictures, until they eventually describe the main elements of the pictures correctly. By any definition of the term, this is not subliminal. What is important, however, is not the objective subliminality of the stimuli, which will always be difficult to establish, but the fact that the stimuli appear distorted to the subjects. This lack of clarity, or stimulus ambiguity, enables the DMT to act like any other projective psychological test so that individual differences in reactions to weak but potentially threatening information may be revealed; where the DMT differs from most, though, is in the apparent predictive value of DMT scores in both research and applied settings. The next section reviews how the DMT has been used as a predictor of psi performance.

Martin Johnson, who had been a student and researcher with the founder of the DMT, Ulf Kragh, first introduced the test to parapsychology in a study conducted with James Carpenter entitled 'An exploratory test of ESP in relation to anxiety proneness' (Carpenter, 1965). Johnson's idea was that 'people who are prone to draw their preconscious blinds in matters of visual perception might act somehow similarly towards perceptions which are extrasensory' (pp.70-71). Like the other parapsychologists referred to in chapter 1, therefore, Johnson was attracted by the notion that subliminal and extrasensory perceptions might share common features.

Ten students with favourable attitudes towards the likely existence of ESP were ranked according to their performance on a restricted-choice clairvoyance task. The DMT was also administered to subjects and Johnson ranked their scores on this test (in a methodological flaw, this ranking was not done 'blindly' of the ESP scores; later studies were to correct this flaw). It was found that there was a significant positive correlation (r_p=.79, *9df*, p<.01) between the DMT and the ESP scores, such that subjects showing a relatively high level of defensiveness would tend to perform below chance on the ESP task, while subjects with a low level of defensiveness showed ESP scores generally above chance expectation. (Note that later published summaries of this study give the correlation as Spearman's rather than Pearson's; the probability level of the correlation does not, however, differ between the two measures, and so conclusions are not affected by this ambiguity.)

Since then there have been a further 15 experiments directly comparing subjects' performance on the DMT to their performance in restricted-choice psi tasks (usually called the DMT-ESP studies). These experiments have been conducted by researchers in the USA, Holland, and Iceland, but it is important to note that two principal investigators, Martin Johnson and Erlendur Haraldsson, have been involved in most of these studies. A distinctive feature of the Icelandic experiments is that they were planned at the outset to be a series of ten studies conducted and reported systematically to enable detailed comparisons between the studies. Haraldsson and Johnson have used a convention of labelling the DMT-ESP studies by country and order of publication, and table 2.1 gives the full authorship of each study.

These 16 studies all used broadly similar methods and the features of a typical experiment were as follows. Subjects were volunteer undergraduate students (the Icelandic series used male subjects only and tried to avoid using psychology students). There were two testing sessions. In one, subjects were administered the DMT (Martin Johnson, with his extensive experience of the DMT, usually administered the test) and in the other session the subjects took one or two ESP tests (the order of the two sessions varied unsystematically across experiments; there was no attempt to counterbalance the order of the ESP tasks administered to subjects, and there is no indication in the published reports of the DMT-ESP studies whether or not the order of testing affected the results). In the Icelandic series, psychology students administered the ESP tests. The DMT was administered to groups of subjects rather than individually, so a slide projector with a camera shutter was used (rather than a tachistoscope) to project the stimuli on to the rear of a semi-transparent perspex screen.

Table 2.1
Identification of the principal DMT-ESP studies

Label	**Authors**
US I	Carpenter (1965)
US II	Johnson & Kanthamani (1967)
US III	Johnson & Kanthamani (1967)
DUTCH I	Johnson (1975)
DUTCH II	Johnson & Lübke (1977)
DUTCH III	Houtkooper, unpublished, results reported in Haraldsson, Houtkooper & Hoeltje (1987)
ICELANDIC I	Haraldsson (1978)
ICELANDIC II	Johnson & Haraldsson (1979)
ICELANDIC III	Haraldsson & Johnson (1979)
ICELANDIC IV	Johnson & Haraldsson (1984)
ICELANDIC V	Johnson & Haraldsson (1984)
ICELANDIC VI	Haraldsson & Johnson (1986)
ICELANDIC VII	Haraldsson, Houtkooper, & Hoeltje (1987)
ICELANDIC VIII	Haraldsson & Houtkooper (1992)
ICELANDIC IX	Haraldsson & Houtkooper (1992)
ICELANDIC X	Haraldsson & Houtkooper (1992)

The ESP tests were of restricted-choice clairvoyance or precognitive design, and the Icelandic studies and US studies II and III attempted to encourage some light-hearted competition between subject pairs participating in the ESP test. For example, in Icelandic V the first ESP test was a forced-choice clairvoyance computer game with feedback. Subjects worked in pairs, alternating periods at the computer until each had completed 40 trials. Rewards (such as a book token or an LP record) were sometimes offered to encourage high scoring on this test. The second ESP test was 40 trials of a forced-choice precognition test, where subjects had to guess which of four letters would later be selected by a computer as their targets. Sometimes, questionnaires were also administered to measure subject personality and

Table 2.2
Summary of the psi tasks used for the DMT-ESP studies

Study	First psi task	Second psi task
US I	Clairvoyance[a]	-
US II	Clairvoyance	-
US III	Clairvoyance	-
Dutch I	Clairvoyance	-
Dutch II	Clairvoyance	-
Dutch III	Clairvoyance & PK[b]	
Icelandic I	Clairvoyance	Precognition
Icelandic II	Clairvoyance	Precognition
Icelandic III	Clairvoyance	Precognition
Icelandic IV	Precognition	Clairvoyance
Icelandic V	Clairvoyance	Precognition
Icelandic VI	Clairvoyance	Precognition
Icelandic VII	Clairvoyance	Clairvoyance
Icelandic VIII	Clairvoyance	Clairvoyance
Icelandic IX	Clairvoyance	Precognition
Icelandic X	Clairvoyance	Precognition

[a] The brief report of this study (Carpenter, 1965) states that three 'very different' ESP experiments took place using the same subjects. Only two of the three experiments showed 'striking associations' between ESP and DMT scores, and details of the psi task are given for only one of these; this was a forced choice clairvoyance task.

[b] Details of this study have not been published; it is briefly mentioned by Haraldsson et al. (1987), and by Johnson & Haraldsson (1984). The latter describe the psi task as 'a complicated combined computer test of clairvoyance and of retroactive PK' (p.195).

attitudes towards ESP. Table 2.2 summarises the psi tasks used for the various DMT-ESP studies.

Thirteen of the 16 DMT-ESP studies operated a double-blind procedure where the DMT ratings and the ESP scores were independently calculated and were then correlated at a later date. Typically, Ulf Kragh or Martin Johnson rated the DMT protocols. As is seen in table 2.3 (page 40), while there was a significant overall correlation between level of defensiveness and direction of ESP scoring (combining the two psi task scores) where high defensive individuals tended to score poorly at ESP and low defensive individuals tended to score well at ESP (see the meta-analysis to be described shortly), overall ESP scores have tended to be non-significant. Haraldsson & Houtkooper (1992) reported, however, that of the two ESP tasks in the Icelandic series (clairvoyance and precognition), the combined precognition score (based on the number of hits or correct guesses obtained) for the ten studies was statistically significant (z=2.413, p=.008, 1-t). Combining scores for both psi tasks, there was a significant decline in the strength of the DMT-ESP correlation both within the Icelandic series (r_S=.636, N=10, p<.05, 2-t) and over all 16 studies (r_S=.794, N=16, p<.001, 2-t) (Haraldsson & Houtkooper, 1992).

An Icelandic version of the Eysenck Personality Questionnaire was administered in Icelandic studies V, VII, VIII, IX, and X, and an Icelandic version of Cattell's 16PF test was administered in Icelandic studies I, II, and III. Haraldsson & Houtkooper (1992) found no significant relationships between Neuroticism, Extraversion, and psi performance (there was a significant negative correlation between Psychoticism and combined psi scores [so that subjects low on psychoticism scored relatively high on ESP; Z=-2.071, p=.038, 2-t], but as this is a *post hoc* finding replication is needed). Also, no significant correlation was found between Neuroticism, Extraversion, and DMT scores. This latter finding is in accord with Kragh & Smith's (1970) finding that DMT scores were unrelated to other major personality dimensions; Cooper & Kline (1986), too, found only small correlations between DMT scores and 16PF scores (though the general pattern of correlations was as predicted by percept-genetic and Freudian theory).

Meta-Analysis of the DMT-ESP Studies

As the findings reviewed in the previous section show, there have already been some attempts to analyse the DMT-ESP studies as a group (Haraldsson, Houtkooper, & Hoeltje, 1987; Haraldsson & Houtkooper, 1992), but these attempts consisted primarily of calculations of combined significance levels. There has been no reported effort to estimate the overall magnitude (that is, effect size) of the DMT-ESP correlation, and its confidence limits; only recently (Haraldsson & Houtkooper, 1992) has there been any attempt to establish the homogeneity (consistency) of the findings of the DMT-ESP studies. It was decided, therefore, to conduct a meta-analysis of the 16 principal DMT-ESP studies, using the data reported in table 2.3.

Honorton, Ferrari & Bem (1990) describe a simple technique for the meta-analysis of correlation coefficients (using procedures detailed by Hedges & Olkin, 1985, and Rosenthal, 1984) and this technique was applied to the DMT-ESP data shown in Table 2.3. Spearman correlation coefficients were converted to their Fisher z equivalents, were weighted by their *df*, and averaged; two-tailed significance levels and 95% confidence intervals were calculated; *chi-square* tests of homogeneity were conducted and mean zs were transformed back to r as an indicator of effect size. The results of this meta-analysis are summarised in Table 2.4.

Table 2.3
Results of the DMT-ESP studies (adapted from Haraldsson & Houtkooper, 1992): number of participants(N), Spearman's rho for overall ESP scores and DMT scores, and statistical significance of DMT-ESP correlation.

Study	***N***	***rho***	***p*(1-t)**	**Notes**
US I	10	.79	.01	Pilot study, not double-blind.
US II	16	.67	.005	Pilot study, not double-blind.
US III	11	.59	.05	
DUTCH I	18	.42	.05	Pilot study, individual DMT testing.
DUTCH II	49	.26	.05	
DUTCH II	16	-.19	NS	
ICELANDIC I	37	.47	.002	
ICELANDIC II	37	.17	NS	
ICELANDIC III	41	.02	NS	
ICELANDIC IV	54	.25	.03	Only partially double-blind. Prior selection of subjects based on extreme dream recall questionnaire scores or extreme scores on precognition test.
ICELANDIC V	46	.11	NS	
ICELANDIC VI	44	.06	NS	
ICELANDIC VII	48	.11	NS	
ICELANDIC VIII	50	-.09	NS	
ICELANDIC IX	50	-.04	NS	
ICELANDIC X	55	.10	NS	

Icelandic studies VII and VIII gave two clairvoyance tests, the other Icelandic studies gave one clairvoyance and one precognition test; in study IV the precognition test preceded the clairvoyance test, in all other studies the clairvoyance test was administered first (see table 2.2). The correlations shown are between DMT scores and total ESP scores.

Table 2.4
Meta-analysis of DMT-ESP studies

Study Grouping (*N* studies)	***N*(Ss)**	**Effect size (r_s)**	**95% c.i. From**	**To**	***Z***	***p*(2-t)**	***ChiSq*(*df*)**
All (16)	582	.16	.08	.24	3.82	.00014	27.84(15df)[1]
Icelandic(10)	462	.11	.02	.20	2.32	.02028	10.01(9*df*)
US(3)	37	.68	.30	.78	4.43	.00001	.60(2*df*)
Dutch(3)	83	.22	-.01	.42	1.91	.05572	3.09(2*df*)
Double-Blind(13)	502	.12	.03	.21	2.65	.00797	15.44(12*df*)
Not Double-Blind(3)	80	.42	.18	.57	3.75	.00018	6.12(2*df*)[2]

[1] $p<.025$
[2] $p<.05$

Table 2.4 demonstrates that, with the exception of the marginally significant Dutch sub-group of studies, the DMT-ESP relationship is statistically significant (overall p=.00014, 2-t); however the size of the correlation is fairly modest (r=.16 overall) and the 95% confidence interval for the effect ranges close to zero (from .08 to .24). The greatest effect size (r=.68) is found for the 3 US studies, however 2 of these were not double-blind, so that the DMT scorer might be aware of a subject's ESP scores, thus perhaps unconsciously influencing his interpretation of the DMT protocols in the expected direction and enhancing the DMT-ESP correlation. The correlation for the 1 double-blind US study was higher than all the other double-blind studies, raising the possibility that the US results may not be homogeneous with the northern European results. The Dutch and the Icelandic studies do not have significantly different correlations from each other or from the overall group of studies. The statistically significant homogeneity value for all 16 studies (χ^2 = 27.84, 15df, p<.025) indicates that there is a significant amount of heterogeneity in the DMT-ESP studies overall, and the not double-blind studies are also significantly nonhomogeneous (χ^2 = 6.12, 2df, p<.05). The 3 US studies provide the prime source of homogeneity (χ^2 = .60, 2df). In other words, the study outcomes are fairly inconsistent overall and the US studies are most consistent.

'Miscellaneous' DMT-ESP studies

In addition to the 16 principal DMT-ESP studies included in the meta-analysis, there are a few others which are relevant to this review, though they are too diverse in their methodology to be directly compared with the main studies through a meta-analysis (Haraldsson et al., 1987)

Miller & York (1976) created their own 'unofficial' version of the DMT, and selected high and low scorers from this test to participate in a subsequent free-response clairvoyance task incorporating a relaxation tape with an 'impression period'. No significant 'DMT'-ESP correlation was found, though results were in the expected direction. A follow-up study by York (1977) gave subjects the DMT and in a subsequent session subjects participated in a free-response 'ganzfeld' clairvoyance procedure. In the ganzfeld procedure used for this study, subjects were not exposed to red light and did not hear continuous white or pink noise. Instead, they listened to a muscular and mental relaxation tape which concluded with five minutes of white noise as an 'impression period' followed by a reminder to relax then a second five minute white noise impression period. Full results for this study have not been published, but are included in an unpublished paper (York & Morris, 1978). A comparison of two groups of relatively high and relatively low DMT scorers found no significant difference between the groups' ESP scores (t=.82, 26*df*, p>.30, 2-t). However the study did yield significant psi scoring (Z=2.92, p<.005, 2-t). The authors suggest that the reason why the DMT failed to predict psi scores could be because the ganzfeld procedure and the relaxation tape might be less likely to activate defences than the experimental conditions typically seen in the principal DMT-ESP experiments, where there is often an attempt to create a competitive situation which may raise subjects' stress levels. Morris has also noted (personal communication, 1993) that the DMT scores for this study indicated that subjects tended to be fairly low defensive overall, perhaps reflecting the 'laid back' nature of the Californian student sample at this particular university (University of California, Santa Barbara).

Similar results and conclusions were reported in a study by Haraldsson & Gissurarson (1985) (which claims to be the first to compare DMT scores with free-response ESP performance in the ganzfeld). They selected high and low DMT scorers from Icelandic VII, but found no significant DMT-ESP correlation; in fact the observed small correlation was opposite to the predicted direction. The authors speculate (like York and Morris) that the failure of the DMT-ESP correlation to generalise to their study could be due to the use of the ganzfeld condition in the ESP test. Perhaps the ganzfeld is insufficiently stressful for the subject to activate defence mechanisms. They note also that in psychoanalytic theory, free association (similar in some respects to the ganzfeld situation) has been considered to decrease the operation of defence mechanisms.

These findings may suggest that whatever aspect of the subject that is measured by the DMT is influenced by the experimental setting: studies which have been designed to engender some stress in subjects have generally shown a positive DMT-ESP correlation, whereas no significant correlation is seen in studies where there have been attempts to reduce subjects' stress levels through the use of the ganzfeld and relaxation procedures. A confounding factor may be that the former studies have generally used restricted-choice ESP tasks, while the latter have used free-response ESP tasks, so that the nature of the psi task may also interact with the subjects' DMT performance.

Other studies relevant to the DMT-ESP work have been carried out by Johnson & Hartwell (1979) and Johnson & Nordbeck (unpublished, cited in Johnson & Kanthamani, 1967). The former was an exploratory study which tried to relate defensiveness to success at guessing and changes in galvanic skin response as the ESP measures. As it was testing no specific hypotheses and few subjects showed sufficient extremes of defensiveness to allow an examination of the DMT-ESP relationship, this study was not included together with the principal studies. The latter experiment was also a preliminary test utilising an exploratory scoring system for the DMT. Rather than evaluating subjects' protocols according to the usual 9-point rating scale, it was decided to look only for one 'positive' and one 'negative' indicator (the idea being that these indicators were relatively easy to identify in DMT protocols even for an inexperienced rater). The 'positive' indicator was the C-phase (correct phase) criterion (briefly, an indication that the subject has correctly perceived the main elements of the stimulus picture). The 'negative' indicator was a sign of isolation described as 'threat discontinuity' (briefly, the subject identifies a threat in the earlier, short stimulus exposures, but ceases to identify this threat in later, longer duration exposures). It was found that significantly more 'psi-hitters' than 'psi-missers' reached the C-phase criterion (p=.0149, 1-t); more psi-missers showed the negative indicator than did psi-hitters, though this was not statistically significant (p=.0650, 2-t).

Discussion

Drawbacks of the DMT and suggestions for a conceptual replication of the DMT-ESP studies.

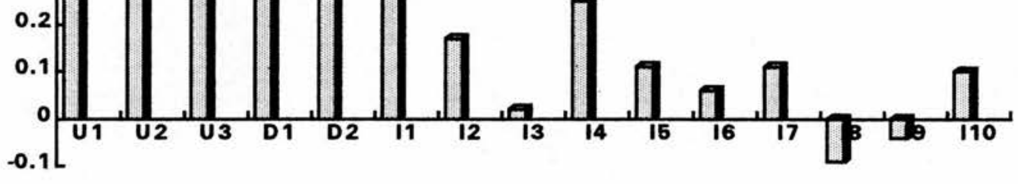
This review and meta-analysis has demonstrated that there exists a statistically significant correlation between DMT scores and ESP performance, such that 'high defensive' individuals tend to score lower on ESP tasks than 'low defensive' individuals, and Palmer (1986b) cites the replicability of the DMT-ESP studies as one of the more significant accomplishments of experimental parapsychology. The meta-analysis shows, however, that the overall effect size is quite weak (*r*=.16) with 95% confidence intervals coming close to zero (from .08 to .24). The results of the studies comparing free-response ESP performance to exploratory versions of the DMT have been inconclusive, but other studies (discussed at the beginning of this chapter) have supported the defensiveness-psi relationship using alternative measures of defensiveness or related personality characteristics (related in the sense that these characteristics may contribute to distortions of reality or resistance to unpleasant, stressful, or threatening information).

The decline in the DMT-ESP correlation over time, shown graphically in figure 2.1, may be because the earliest studies were not double-blind, perhaps leading to an artefactual inflation of the correlation for these studies. However, even excluding the studies which were not double-blind, there remains a pattern of declining DMT-ESP correlations that resembles the famous 'decline effect' that has been observed within and between many parapsychological experiments (Palmer, 1978), often thought to be due to declining motivation and interest both on the part of experimenters and subjects.

The decline in DMT-ESP correlations over time is statistically significant, both for all 16 studies (r_S=0.794, N=16, p<.001, 2-t) and for the 10 Icelandic studies (r_S=0.636, N=10, p<.05, 2-t) (Haraldsson & Houtkooper, 1992). There is a confound, of course, between the decline in the DMT-ESP effect over time, and the country in which each study was conducted, with the earliest studies being US, the next being Dutch I and II (there is no published information on the date that Dutch III was conducted), and the most recent being the Icelandic series. If, in figure 2.1, we consider the correlations by country, we see that the clearest declines are for the US and Dutch studies (recall that the first two US studies were not double-blind). For the Icelandic studies, there is an obvious peak for Icelandic I, and then the remaining studies are actually quite varied in their results; the significant decline effect for these studies is probably attributable to the results of Icelandic I and Icelandic VIII and IX.

It has been suggested that the pattern of correlation in the DMT-ESP studies represents some kind of initial effect or experimenter effect, as each of the experimental series was begun with fresh energy and enthusiasm by either Martin Johnson or Erlendur Haraldsson (Haraldsson & Johnson, 1979).

Figure 2.1
DMT-ESP correlations (r_s), presented chronologically; U=US; D=Dutch[a]; I=Icelandic.



[a] Dutch Study 3 is not included in this graphic because there is no published information regarding the date that this study was conducted; the DMT-ESP correlation for Dutch Study 3 was -0.19.

Because different student experimenters conducted the ESP tests in the Icelandic series, though, this might be expected to circumvent the decline effect to some extent. Alternatively, it is possible that the declining correlations reflect unreported changes in subjects' or experimenters' attitude, methodology, or analysis of results. For instance, Haraldsson & Houtkooper (1992) speculate:

> Could the prevalence of increasingly bloody horror movies explain the decline in the series of DMT-ESP correlations, by lowering the intensity of the perceived threat or lack of identification with the central person which is displayed in the DMT? (p.1094).

The authors themselves stress the need for independent replication of the DMT-ESP studies (Johnson & Haraldsson, 1984; Haraldsson, Houtkooper, & Hoeltje, 1987), as most of these studies have been conducted at least in part by only two researchers: Johnson and Haraldsson. Given that one of the criticisms often levelled at parapsychology is a lack of repeatability (which can be due to lack of replication attempts, which is the case for the DMT-ESP studies, or to failed replication attempts), why is it that other parapsychologists have been slow to follow-up on these promising findings? The answer may lie with some of the practical and theoretical difficulties associated with the DMT.

Drawbacks of the DMT. It is likely that practical difficulties in using the DMT have discouraged other researchers from following-up the DMT-ESP studies. Firstly, at least three months' intensive (and expensive) training is needed to learn how to administer and score the DMT. Even after the basic training, it may take many years before testers can code subjects' protocols for the presence or absence of the 10 defensive signs with sufficient objectivity to achieve a respectable degree of inter-rater reliability. Of studies of DMT inter-rater reliability, Kragh notes:

> The inter-rater reliabilities are low to satisfactory in comparison with ordinary aptitude tests, and as good or better than those of ratings based on projective methods. The reliability coefficients seem to correlate positively with the increased training of the rater, and with the use of the complete code version. The coefficients vary between .57 and .90 with a mean (for all raters) of .70. (Kragh, 1970, p.185)

Icelandic study IV reported an impressive inter-rater reliability between Ulf Kragh and Martin Johnson of between r=.90 and r=.93. However, Johnson was a student and researcher with Kragh, the founder of the DMT. No other parapsychologists have had the opportunity of such close collaboration with the originator of the test. While researchers have argued that the DMT scoring scheme 'requires few interpretations by the rater' (Cooper & Kline, 1986, p.22), it does seem that 'objective' scoring is more easily achieved by experienced raters. Few psychologists outside of Scandinavian countries are familiar with the DMT, and there is only one published translation of the complex scoring scheme into English (Westerlundh, 1976; there is also an English translation in an unpublished PhD thesis by Cooper, 1982). Experienced raters are therefore relatively rare, thus perpetuating the lack of familiarity with the DMT.

Another drawback of the DMT is that it is rather time-consuming to administer and score. Group testing (with around 4 to 7 subjects, a procedure used for all the DMT-ESP studies, with the exception of Dutch study I; information on DMT testing conditions has not been published for Dutch study III and for US study I) is obviously a quicker means of DMT administration than individual testing, but outside of parapsychology individual testing is preferred to group testing because the latter makes it difficult to ensure that each subject experiences identical levels of stimulus and background illumination, identical angles and distances from the screen, and so on. Irrespective of whether individual or group testing is used, the analysis of each subject's series of responses to the DMT stimuli must be done individually, and this is a lengthy process. When resources of time and money are scarce, parapsychologists might be more inclined to use a more convenient measure of defensiveness.

A third drawback of the DMT is the question of validity, which has already been mentioned above when considering the theoretical assumptions underlying the DMT. Certainly the DMT appears to have validity in applied settings; but it is not yet clear what exactly the DMT is measuring - is it the operation of Freudian defence mechanisms, is it perceptual distortions caused by physiologically arousing emotional stimuli, or is it measuring something else entirely? When parapsychologists come to question the reasons underlying the defensiveness-psi correlation (that is, process-oriented questions about the relationship between psi performance, the nature of the psi task, and aspects of the subject's motivation, attitudes, personality, and perception, and what all of these might suggest for information-processing models of psi), they will need to have a clearer idea of the dynamics behind DMT responses.

Related to this question of validity, is that concerning the aim of the DMT. It is principally geared to identifying individuals on the dimension of defensiveness, so that scores may indicate a person to be 'high defensive' or 'low defensive'. As Kragh and Smith (1970) point out:

> ...the negative influence of pathogenic factors has so far been almost the exclusive object of investigation in the DMT, while the task of extricating 'positive' control mechanisms is still in abeyance. (p.179)

In chapter 1 it was noted that in the paradigm of subliminal perception, there are two sides to perceptual defensiveness: 'perceptually defensive' individuals are slower to report awareness of emotive stimuli compared to neutral stimuli; others, known as 'perceptually vigilant', identify emotional stimuli more rapidly than neutral stimuli. It may be that the DMT is very good at identifying perceptually defensive individuals because it is designed to do this: its original development, it will be recalled, was as an instrument to select out pilots likely to be involved in accidents. It is not clear, however, whether a 'low defensive' score is equivalent to 'perceptually vigilant' (= 'especially alert or sensitive to danger') or to a 'lack of defensiveness' (= 'not resistant to stressful or threatening information'). Kragh and Smith (1970) do seem to imply that the dimensionality of defensiveness has not yet been fully elucidated. Parapsychologists, however, may also profit from identifying perceptually vigilant individuals, as there is some indication from the research outlined above (for example, research showing that individuals who are relatively open or susceptible to subliminal perception also perform relatively well at psi tasks; Roney-Dougal, 1987) that these individuals might be expected to score above chance expectation in a psi task.

The above-mentioned problems should not overshadow the fact that the DMT can successfully predict responses to environmental stress in a practical setting. Further, it already has an honourable place in parapsychological research. This position may be strengthened by those future studies which are planning to use the DMT. Adrian Parker, for instance, is studying the relationship between absorption, defensiveness as measured by the DMT, and reported anomalous experiences, from clinical, cognitive and parapsychological perspectives (Parker, 1989). Another question worth following up is whether the DMT-ESP correlation is specific to restricted-choice ESP tasks, as the results of studies comparing DMT performance to free-response ESP performance have been inconclusive (Miller & York, 1976; York, 1977, results in York & Morris, 1978; Haraldsson & Gissurarson, 1985). York and Morris (unpublished) suggest that further studies should look at the DMT-ESP correlation in different psi-testing modes, for example competition versus no competition, use of psi-conducive procedures versus non-psi conducive procedures. Research along these lines may give further insight into the relationship between defensiveness and psi scoring.

Towards a conceptual replication of the DMT-ESP studies. The early part of this chapter reviewed a miscellany of studies that had used a variety of different indicators of defensiveness (defined broadly as a tendency to distort or to resist potentially unpleasant or threatening information) and that had related subjects' performance on these measures with their psi performance. These studies were inspired by a common idea that there was some similarity in people's unconscious reactions to weak information, whether that information be of 'normal' or 'extrasensory' origin. Generally, the findings of these 'defensiveness-psi' studies indicated a tendency for individuals who were relatively low defensive, or 'open', to perform relatively well at psi tasks. Due to their variety, however, it is difficult systematically to compare and replicate these studies.

The DMT-ESP studies, on the other hand, while conceptually related to the studies using different measures of defensiveness, have been conducted in a more systematic fashion, using a test that has been extensively researched and developed as a measure of defensiveness in its own right. The DMT-ESP studies are therefore amenable to direct and quantifiable comparisons with one another, as well as to replication attempts. I have outlined some reasons why parapsychologists other than Johnson and Haraldsson have tended not to attempt exact replications of the DMT-ESP studies; probably the practical difficulty of lack of expertise has played the greatest role in discouraging parapsychologists from following up the DMT-ESP studies. However, the promising DMT-ESP findings can also be followed up by research which is conceptually similar, though not using the DMT itself as an indicator of defensiveness.

It is one of the principal aims of this thesis to explore an alternative 'objective' measure of defensiveness, using the definition of perceptual defence/vigilance found in the subliminal perception paradigm. The aim would be to overcome many of the problems, outlined above, associated with the use of the DMT, and to introduce a methodology that could facilitate process-oriented research into defensiveness/vigilance and its relationship to psi performance. This comparison of psi and defensiveness is based on the theoretical assumption (originally elucidated by Tyrrell's two-stage model of psi (1947) and, as described in chapter 1, later adopted implicitly or explicitly by many parapsychologists) that common processes may act to distort or transform weak unconscious perceptions, whether these perceptions are subliminal or extrasensory in origin.

In order to progress towards this aim it is necessary and informative to review, in chapter 3, some of the principal measures of defensiveness used in psychology.

Chapter 3. Review of measures reported to demonstrate perceptual defence/vigilance.

This chapter reviews different measures of defensiveness with a view to identifying a simple and effective method suitable for use in studies of defensiveness and psi. Firstly, 'Serial' and 'Paper and Pencil' techniques are briefly discussed. For a more detailed examination of these measures of defensiveness, see Cooper (1982), whose PhD thesis was concerned with the experimental investigation of Freudian defences; Smith & Kragh (1970) review the techniques employed in percept-genetic research, together with an account of the history of these techniques; and Kline (1981) considers defence mechanisms as they are conceptualised in Freudian theory. Later in this chapter, more detailed consideration will be given to subliminal perception techniques, after a discussion of what constitutes awareness.

'Serial' Measures of Defensiveness

The Defence Mechanism Test is only one of several measures of defensiveness that share the assumption that perception is an adaptive process, reflecting the operation of both internal (personality and motivation) and external (stimulus) variables. 'Serial' methods, such as the DMT, the Stroop Test, After-Image and After-Effect techniques, and the Metacontrast technique, aim to examine the perceptual process, or subjects' reactions to stimuli over time, by prolonging, fractionating, or intermittently interrupting the presentation of the stimulus (Smith & Kragh, 1970).

The Serial Colour-Word (Stroop) Test (Stroop, 1935) presents subjects with columns of names of different colours, printed in different colour ink (for example, the word 'red' printed in green ink). The subject is required to say out loud the printed word, ignoring the colour in which it is printed. Originally, researchers were only interested in overall reading times for interference and non-interference series (Thurstone, 1943). The test was later adapted as a serial technique by scoring the reading time of the subject after 20, 40, 60, 80, and 100 words (e.g. Smith & Klein, 1953). Depending on the pattern of errors made, the subjects are classified into one of three 'cognitive styles' that can be related to clinical variables (for example, anxious subjects' performance steadily deteriorates).

After-Image (e.g. Smith & Kragh, 1967) and After-Effect (e.g. Andersson, 1962) techniques observe subjects' reported perceptual experiences after they have been looking at repeated exposures of, respectively, an intense stimulus (e.g., a simple red figure with a sad mouth in black) or a rotating spiral pattern. Again, it is hypothesised that by prolonging or fractionating the presentation of a visual stimulus, individual differences in behavioural reactions to the experience can be noted. The nature of subjects' reports is thought to vary systematically depending on the subjects' psychopathology (Smith & Kragh, 1970).

The Metacontrast Technique (e.g. Bokander & Radeborg, 1967) examines how a stimulus that is presented very briefly (tachistoscopically), either just before or during exposure of a second stimulus via the tachistoscope, affects the perception of that second

> stimulus. It is thought that incongruous stimuli provoke anxiety and subsequent defences. There are some similarities between the scoring schemes of the Metacontrast technique and the DMT, with the Metacontrast technique scoring revealing signs of 'repression', 'isolation', 'sensitivity', 'projection', 'stereotypy', 'depression', 'instability', 'discontinuity', and 'psychosis and abnormity' (Smith & Kragh, 1970).

Cooper (1982) concludes that all of these serial techniques have only limited application because although they can differentiate between 'clinical' groups of individuals (e.g. schizophrenics versus depressives), fewer distinctive signs of defensiveness are seen for 'normal' individuals. The DMT is seen as a clinical test because expert understanding is required in order to score it reliably.

'Paper and Pencil' Measures of Defensiveness

There also exist 'paper and pencil' scales that purport to measure defensiveness. These include the Repression-Sensitization Scale; the Defense Mechanism Inventory; and the Defence Preference Inquiry. In these tests, subjects are required to introspect about their reactions in hypothetical situations that might evoke defensiveness.

> The Repression-Sensitization (R-S) Scale (Byrne, 1961, 1964; Byrne, Barry, & Nelson, 1963) is a questionnaire that asks respondents to indicate whether statements such as 'My sleep is fitful and disturbed' and 'I believe I am no more nervous than most others' are true or false descriptions of themselves. Individuals' responses to the scale are

considered by Byrne to place them on a continuum according to their characteristic modes of responding to threatening stimuli:

> The repressive extreme involves avoidance defenses, such as denial, while the sensitizing extreme refers to approach defenses, such as intellectualization. (Byrne, Barry, & Nelson, 1963, p.323).

The Defence Mechanism Inventory (Gleser & Ihilevich, 1969; Ihilevich & Gleser, 1986) presents subjects with a booklet containing 10 short stories and sets of possible responses to each situation. The sets of responses are intended to be 'operational definitions' of different defence mechanisms, and the respondents are required to indicate which responses they would be most likely and least likely to make if the events of the story were to happen to them.

The Defence Preference Inquiry (Blum, 1949) shows subjects the 'Blacky Pictures' (Blacky is a little dog performing various acts hypothesised, within Freudian theory, to reflect critical stages of psychosexual development). This test bears some similarity to the DMI test, in that the respondent is required to rank order the likelihood that Blacky is feeling or acting according to a given set of descriptions; each description is intended to correspond to one of the defence mechanisms.

Such paper and pencil instruments purporting to measure possibly unconscious mechanisms such as defensiveness have been criticised because, by definition, individuals cannot have introspective access to unconscious processes, and conscious efforts at suppression will affect scores on, for instance, the R-S scale (Cooper, 1982). The measures do not actually attempt to activate possibly defensive tendencies, so it is possible that these tests are measuring something other than defensiveness.

On a practical level, also, the reliability and validity of some of these paper and pencil measures has been questioned (Kline, 1981). For instance, the Repression-Sensitization Scale has been criticised by Joy (1963) as correlating -.91 with Edwards' (1957) Social Desirability Scale, which may suggest that the R-S scale is measuring conscious response suppression. There have been few studies of the validity of the Defence Preference Inquiry, though there is some evidence that this relates to measures of perceptual defence (e.g. Blum, 1955) in ways that would be expected if the Defence Preference Inquiry measures repression validly. While the Defence Mechanism Inventory is described by its founders as 'An objective instrument for measuring defence mechanisms' (Gleser & Ihilevich, 1969), Kline (1981) reviews studies conducted with the DMI and concludes: 'there is little evidence attesting to the validity of the DMI variables...Nor can the scales be used as objective measures of defences' (p.251).

It would be desirable to identify a measure of defensiveness that measures an aspect of individuals' perceptual experience outwith their conscious control. The third class of purported measures of defensiveness that will be considered are 'objective' insofar as they show high objectivity in their scoring and are difficult to fake by subjects. These are studies of perceptual defence, within the subliminal perception paradigm.

Introduction to Subliminal Perception

In a subliminal perception task, subjects are presented with a stimulus which is either so weak in intensity or of such short duration that they claim to be unaware of any stimulation. Researchers then look for any influence of that subliminal stimulus on the subjects' subsequent behaviour such as their response to a following stimulus; such influence is thought to indicate that information has been extracted from the perceptual input of which the subject was not consciously aware.

For example, Somekh and Wilding (1973) presented the words 'HAPPY' and 'SAD' subliminally to one eye, and presented a neutral face supraliminally to the other eye. The subjects tended to describe the neutral face as 'happy' when it was presented in association with the subliminal 'HAPPY' stimulus, and to describe the neutral face as 'sad' when it was presented in association with the subliminal 'SAD' stimulus.

In studies of perceptual defence and perceptual vigilance, attention turns to the 'threshold' area at which the subject begins to become aware of the stimulus. This 'threshold' is variable and diffuse rather than absolute, but this does not mean that it is wrong to speak of a 'threshold'. As Dixon points out, one may allow the notion of threshold as a 'fuzzy' limen that varies from time to time; thus a stimulus is subliminal if it is 'below the range over which a limen may vary' (Dixon, 1981, p.188).

It is thought that the emotive nature of some stimuli alter physiological sensitivity thus raising (perceptual defence) or lowering (perceptual vigilance) awareness thresholds (e.g. Brown, 1961, Dixon, 1981). As awareness thresholds may vary from one individual to another (e.g., due to differing baseline arousal level, response tendencies, eyesight), it is usual for experiments in perceptual defence/vigilance firstly to establish for each subject that level of stimulus intensity or duration that corresponds to the subject's awareness threshold. This may be done, for instance, by presenting a stimulus quite clearly, and then at gradually decreasing intensity or duration, until the subject reports no awareness of the stimulus (or, say, correctly identifies the stimulus only 50% of the time; criteria for establishing awareness thresholds have varied from one experimenter to the next, and are to some extent arbitrary). Alternatively, one could begin with extremely brief or low intensity subliminal stimulus exposures, and gradually increase them until the awareness threshold is reached.

Subliminal perception is often confused with what may be termed 'nonconscious perception' (Price, 1990). The former specifically attempts to present stimuli below the limen, or threshold, of awareness. The latter can refer to any technique that presents stimuli outside of awareness, for instance while the focus of attention is elsewhere (such as in the dichotic listening paradigm where subjects attend to input to one ear and ignore input to the other), or where a briefly presented visual stimulus is followed by a 'mask' (usually consisting of jumbled stimulus fragments) which can 'obscure' awareness of the initial stimulus. Thus, subliminal perception is a subcategory of nonconscious perception.

There have been extensive criticisms of subliminal perception experiments, especially the early ones; for details of these, including rebuttals of many criticisms, see the numerous literature reviews considering the strength of the evidence for subliminal perception: Adams, 1957; Bevan, 1964; Dixon, 1971, 1981; Dixon & Henley, 1980; Eriksen, 1960; Goldiamond, 1958; Holender, 1986; Merikle & Cheesman, 1987; Shevrin & Dickman, 1980; and Greenwald (and accompanying articles). Dixon (1981) probably gives the most comprehensive review of criticisms of subliminal perception studies. Some of the criticisms are less damaging to the case for subliminal perception than others. Among the weaker arguments reviewed (and countered) by Dixon are that:

1. subliminal perception effects are so slight that they are trivial (but small effects may nevertheless be important);

2. it is logically impossible for something to be perceived in order not to perceive it (perhaps this is an objection if processing were sequential or only on one level; but if one allows for parallel processing, or processing at nonconscious as well as conscious levels, there is no conundrum);

3. the unconscious cannot be more sensitive or discriminating than the conscious (this is a misunderstanding of the literature; actually, the subliminal perception literature neither claims nor implies that the unconscious is 'supersensitive' compared to the conscious);

4. subliminal perception is physiologically impossible - there exist no brain mechanisms for transmitting, interpreting and responding to information without conscious representation (Dixon counters that, in fact, there exist brain mechanisms that could enable perception without conscious awareness).

The remaining objections to subliminal perception reviewed by Dixon (1981) are, in my opinion, more serious (this fact has, however, been recognised by researchers via methodological improvements in relatively recent studies). Briefly:

5. there are 'alternative explanations' for apparent subliminal effects, implied in failures to replicate studies that originally successfully demonstrated subliminal perception effects. Dixon argues that the unsuccessful replication studies often include methodological characteristics that:

> render it likely that subliminal stimuli will be ineffective, either because they never register, through interference at the peripheral receptor, or because attention is directed away from the modality in which subliminal stimuli are being applied, or because other, competing, response tendencies militate against the subject's ability to signal that he has registered a stimulus below the awareness threshold. (Dixon, 1981, p.191)

6. subjects in subliminal perception studies are able to show signs of having perceived the stimulus because the stimulus is not truly subliminal - there are actually partial cues as to the stimulus identity; thus, for instance, apparent perceptual defence to taboo words (as indicated by higher recognition thresholds for taboo than for neutral words) might represent conscious response suppression by subjects who wish to avoid the embarrassment of wrongly identifying as taboo a partially perceived word that might be neutral. (Dixon counters that the partial cue hypothesis cannot account for experiments where subjects have given responses that are semantically related to the 'subliminal' stimulus, but that, contrary to what one might expect if the

subject was perceiving partial information about the stimulus, are *structurally quite different* from the subliminal stimulus. Further, studies showing perceptual *vigilance*, that is, *lower* recognition thresholds for emotional compared to neutral stimuli, are also difficult to account for in terms of partial cues and response suppression).

As Reingold & Merikle (1988) note, it appears that much of the controversy over whether or not subliminal perception has been demonstrated can be traced to the differing (often implicit) assumptions held by different investigators on, for instance, an operational definition of awareness. One such assumption is criticised by Macmillan (1986), who suggests that confusion arises from the implicit definition of a subliminal stimulus as one that is never detected, in combination with the mistaken assumption that an observer will unfailingly say 'yes' to all stimulus detections and 'no' to all failures to detect the stimulus. Merikle (1984) suggests that too many investigators have used a subjective definition of awareness (that is, one based on the subject's reported confidence as to whether or not a stimulus has been perceived). A similar point is made by Bowers (1984), who draws a distinction between *perceiving* and *noticing* information (a notion similar to Cheesman and Merikle's *objective* and *subjective* thresholds), and suggests that researchers have often failed to acknowledge this distinction, thus adding to the controversy.

Current status of research into subliminal perception

While 'subliminal perception' has waned in popularity (and respectability) as a research topic (Dixon, 1981), several nonconscious perception techniques are relatively common in modern cognitive psychology, where they are being used to investigate processes of lexical access and awareness. There is, however, still controversy over whether 'semantic activation without conscious identification' has been demonstrated (see Holender, 1986, and accompanying peer commentary for a comprehensive review of this issue).

The concepts of consciousness and phenomenological awareness have also made something of a comeback in psychology. For instance the June 1992 edition of *American Psychologist* contains a series of articles by leading researchers in the field of subliminal perception and cognitive psychology, debating the capabilities of the unconscious (e.g. Anthony Greenwald; Jerome Bruner; Matthew Erdelyi; John Kihlstrom et al.; and Philip Merikle). How sophisticated is unconscious cognition? Does sophistication reflect complex processes (so that, for instance, the meaning of words and even sentences can be processed), even an ability to deal flexibly with a novel situation (so that, through mechanisms such as repression and projection, the unconscious can protect the conscious mind) (Loftus & Klinger, 1992)?

Although there is still little agreement on what these concepts mean, there is emerging a consensus of opinion that these are worthy topics for study (for a collection of viewpoints about consciousness, see Marcel & Bisiach, 1988). Perhaps this relatively recent acknowledgement that the unconscious is no longer a 'taboo' topic for psychology can be attributed to the waning influence of behaviourism on modern psychology.

Dixon and Henley (1980) argue that there are eleven areas of research that provide converging evidence for the existence of perception without awareness: subliminal perception; binocular rivalry; signal detection experiments; perceptual defence; 'blind sight'; stabilized images; selective attention; sleep and dreams; the Poetzl effect; visual search; and pattern masking. On the other hand, Merikle & Cheesman (1987) feel that controversy continues, and that:

> an answer to the question, 'Does subliminal perception occur?' depends entirely on a) how 'subliminal' or the threshold for perceptual awareness is defined and b) the adequacy of the procedure used to measure this threshold. (p.298)

Not without reason has the notion of perception without awareness stirred controversy. One fundamental problem is that different authors have meant different things by 'awareness' (as was seen in a recent symposium on Consciousness whose speakers included Kathleen Wilkes, Wolf Singer, George Butterworth, and Margaret Boden; November 1992). Not only is there disagreement over what it is to be conscious or aware, but there is also disagreement on what are the best indicators of awareness (Goldiamond, 1958 and Eriksen, 1960, give excellent reviews of this problem). Indicators (e.g. galvanic skin response, dream recall, primed biases, free associations, introspective verbal reports) may vary not only in their sensitivity but also in their appropriateness (Erdelyi, 1986). For instance, the 'dissociation paradigm' (Erdelyi, 1986) that underlies much of subliminal perception research finds evidence for subliminal perception when the subject appears unaware of some stimulus input but nevertheless shows signs of the availability of the same stimulus input. Yet dissociations of awareness are easily demonstrated:

> It is well known that recognition indicators of memory typically yield information estimates greater than those of recall indicators. Yet recognition-recall discrepancies have not usually been treated as instances of subliminal perception or memory...Put differently, how do we decide that a particular indicator of availability...is not simply another indicator of consciousness? (Erdelyi, 1986, p.31)

The variety of different viewpoints in cognitive psychology over what constitutes awareness and what the capabilities of the unconscious are, is illustrated in the target articles by Holender (1986) and Greenwald (1992) and the accompanying peer response. This is obviously still an active topic for debate in contemporary psychology.

Given this controversy, it seems appropriate at this point to take a short diversion to discuss different conceptions of awareness, and to state how awareness will be operationalised in the experiments in this thesis.

What constitutes awareness?

There are two main camps of opinion on what constitutes the threshold for awareness in a perception without awareness experiment. One defines the awareness threshold 'objectively', as the level of discriminative responding corresponding to performance at chance expectation (e.g., Marcel, 1983; Holender, 1986). Signal detection theory methodology is typically used here (e.g. Macmillan, 1986; Cheesman & Merikle, 1985): a finite number of visual stimuli are repeatedly presented at varying intensities or for varying lengths of time and the subject attempts to identify the individual stimuli. The stimulus exposure level at which the subject's identification performance is no better than chance would be the 'objective' threshold - above this level the subject's identification performance begins to improve (even though subjects may still feel that they are receiving so little stimulus information that they are merely guessing), and below this level performance remains at chance expectation.

The other camp of opinion uses a 'subjective' definition of awareness threshold, as the level of discriminative responding at which the subject *claims* to be performing at chance, or guessing (e.g. Bowers, 1984). Typically, the subjective threshold is found at a higher level of stimulus intensity than the objective threshold (Cheesman & Merikle, 1984; 1985). To add to the controversy is the fact that, while at the subjective threshold subjects claim to be performing at chance, their actual performance, measured objectively, is well above chance (Cheesman & Merikle, 1986).

In my opinion, Cheesman and Merikle's (1984) conceptualisation of 'objective' and 'subjective' thresholds best captures the most significant difference between the two views of awareness: the first is supposed to be free of bias; the second is supposed to reflect the subject's phenomenological experience. Whether or not one adopts an objective or subjective definition of awareness depends very much on what phenomena are considered to be intriguing or psychologically important. Many consider the equation of absence of awareness with $d'=0$ in a forced choice detection or discrimination procedure to tell us nothing of what it means to be conscious or unconscious of a stimulus (e.g. Bisiach, 1986; Cheesman & Merikle, 1986; Fowler, 1986; Hardaway, 1990; Morton, 1986; Navon, 1986; and Paap, 1986). As Fowler (1986) says, the subjective threshold "reveals the provocative discrepancy between what perceivers know and 'what they know they know'" (p.34).

I would argue along with the above researchers that the subjective definition of awareness is the more meaningful of the two, but although its ecological validity is a strength, its weakness is its reliance on introspection. Many authors (e.g. Nisbett & Wilson, 1977; Dennett, 1988) feel introspective reports are unreliable as indicators of phenomenal experience, and signal detection techniques have shown that verbal reports are readily biased by, for instance, the trade-off between the rewards (or benefits) for correct detection and the punishment (or costs) for errors. Also, adopting a subjective definition of awareness means that subjects may each adopt their own, idiosyncratic definition of awareness (Merikle, 1984).

In order to resolve the dilemma of using a definition of awareness that captures the experiential nature of awareness but which at the same time is vulnerable to response biases, Cheesman & Merikle (1985, 1986) suggested an additional criterion to distinguish conscious from unconscious perceptual processes: there should be an attempt to establish that the same stimulus could produce *qualitatively different* behavioural effects when presented above or below the subjective awareness threshold. As an example of how this looks in practice, in his study of lexical access Marcel (1980) found that polysemous or ambiguous words (e.g., money-*bank*-river; tree-*palm*-wrist) were differentially processed depending on whether they were presented above or below the level of conscious (reported) awareness. Marcel presented three successive letter strings and asked subjects to indicate whether the first and the third letter strings were words or nonwords. On critical trials, the second letter string was a polysemous word such as *bank* that was either masked or not masked. The reaction time for the lexical decision to the third letter string was taken as an index of the particular meaning accessed by a polysemous word. Marcel found that when all three words were clearly visible, lexical decisions to the third words in triads such as *tree-palm-wrist* were slower than decisions to the third words in triads that contained unrelated words, and the fastest lexical decisions were made to the third words in series such as *hand-palm-wrist*. However, when the second word in a series was masked so that subjects reported no awareness of its presence, Marcel found a quite different pattern of results. In this case, lexical decisions to the third word in triads such as *tree-palm-wrist* and *hand-palm-wrist* were both facilitated relative to the unrelated word triads. In other words, apparently *both* meanings of the second words were activated when these words were presented below the level of reported awareness, while when these words were clearly visible the meaning activated by its presentation was biased by the previously presented word.

From the point of view of the research conducted in this thesis, I would favour a different resolution to the conflict. The validity of an operational definition of awareness is only important to those researchers who are investigating awareness *per se*, and who are making claims that individuals can process the meaning of perceptual information without awareness. In seeking to replicate the DMT-ESP studies conceptually, and in turn to contribute to our understanding of the defensiveness-psi relationship, I am looking for a more easily applied measure of perceptual defensiveness or vigilance than the DMT. With this aim in mind, the question of whether or not subjects are truly unaware of the stimuli is not pivotal or crucial: the apparent similarity that has been suggested to exist between reactions to weak sensory and extrasensory perceptions does not *necessarily* depend on both occurring below the level of conscious awareness; rather, it is thought that both are weak and fragmentary stimuli (like in the DMT) and that as such there may be distortions in their perception and/or interpretation due perhaps to personality, motivational, attitude, and cognitive factors. Thus, while I am adopting the paradigm of subliminal perception, and will be referring throughout this thesis to 'subliminal' stimuli, it is not the aim of this thesis to prove that such stimulation really is subliminal. Rather, it will be assumed that the subjective thresholds adopted by participants in the studies to be described later reflect *reported awareness* (in fact, because my participants are pressing a button rather than speaking to indicate awareness, it is more appropriate to say that these experiments will reflect *signalled* awareness), which may differ from the participant's phenomenal experience.

Introduction to Perceptual Defence and Vigilance

A subcategory of subliminal perception research looks at perceptual defence and perceptual vigilance. Here, the emphasis is less on the influence of a subliminal stimulus on responses to a supraliminal stimulus and more on the marginal 'threshold' area where the subject begins to claim awareness or recognition of the stimulus. Researchers have varied in exactly how they operationalise awareness or recognition in experiments, but Dixon (1981) considers the awareness threshold to be that intensity of stimulus presentation at which subjects become aware that they are being stimulated (e.g., they can see a patch of light), though no other stimulus characteristics (such as shapes or partial letters) are reported; the recognition threshold is reached when subjects begin to see stimulus features that may enable them to identify the stimulus (e.g., they see lines that tell them the stimulus is a picture); once partial cues of the stimulus nature are perceived, then complete stimulus identification may rapidly occur, especially for well-known patterns such as words.

Experiments in perceptual defence attempt to ascertain the stimulus duration or intensity at which awareness or recognition is claimed, and then alter the nature of the stimulus and observe how the threshold alters.

It has repeatedly been found that the nature of the subliminal stimulus material appears to exert an influence over individuals' reported awareness for the stimulus. Some individuals seem to take longer to report awareness for emotional stimuli compared to neutral stimuli; and conversely others appear to perceive emotional stimuli more quickly than neutral stimuli. Jerome Bruner and Leo Postman were the first to name these responses, respectively, as perceptual defence and perceptual vigilance (Bruner & Postman, 1946, 1947). Apart from the reviews of the subliminal perception literature cited above, there are further reviews specifically on the problems of research into perceptual defence/vigilance (Brown, 1961; Natsoulas, 1965; Erdelyi, 1974; Dixon, 1981); many of these problems will be highlighted below, in the discussion of experimental techniques claiming to demonstrate perceptual defence or vigilance.

Theoretical assumptions of perceptual defence studies

Chapter 2 described the Defence Mechanism Test, which uses the Freudian notion of 'defence mechanisms' to suggest a motivational basis to the distortions in descriptions of the DMT stimulus pictures. That is, the subject is threatened by the stimulus and does not wish to perceive it consciously. As is perhaps implied by the words of Kragh & Smith (1970) ('the negative influence of pathogenic factors has so far been almost the exclusive object of investigation in the DMT, while the task of extricating 'positive' control mechanisms is still in abeyance' [p.179]), however, it seems that the DMT is not designed specifically to identify vigilant individuals. Furthermore, it is difficult to interpret the concept of vigilance in Freudian or motivational terms. Kline (1981) argues that the raising of perceptual thresholds for emotive stimuli seen in perceptual defence is related to the Freudian concept of repression (the denial of entry into consciousness); while he acknowledges the phenomenon of perceptual vigilance or sensitization (the apparent lowering of perceptual thresholds to emotive stimuli), it does not appear that this phenomenon has been related to the Freudian defence mechanisms.

Studies of perceptual defence and vigilance have usually attempted to demonstrate that the differential responses to emotional versus neutral stimuli are due to fluctuations in perceptual sensitivity, rather than to motivational or response effects. Indeed, the history of experimental research into perceptual defence/vigilance can be largely characterised as a search for experimental methods and designs to distinguish perceptual effects from the influence of other (confounding) variables. Yet Kline (1981) argues that perceptual defence is actually an example of repression, because Fenichel (1945) states that the defence mechanism of repression may relate not only to internal mental events, but also to the perception of the external, 'real world'.

It seems that there is a need for further research into the relationship between on the one hand perceptual defence and perceptual vigilance, within the subliminal perception paradigm, and on the other hand repression and the other defence mechanisms within the psychoanalytic or Freudian paradigm. Is there any evidence to back up Fenichel's assertion that repression relates also to external perceptions? Are the apparent perceptual distortions seen with tests such as the DMT distortions of incoming perceptions or of outgoing reports of perceptual experiences, or a combination of the two? Dixon, an influential researcher in subliminal perception until his retiral, considers that perceptual defence and vigilance reflect relatively automatic fluctuations in physiological arousal, mediated by systems within the brainstem, in response to emotive stimuli. While he is aware of psychodynamic interpretations of defensiveness, Dixon stresses the physiological nature of the phenomena of defensiveness and vigilance.

Perhaps these two camps, the physiological/subliminal perception camp and the motivational/Freudian camp, are merely different ways of looking at the same phenomena. Perhaps they merely represent different levels of explanation for the same phenomena, with, for instance, the psychodynamic paradigm explaining the *why* of defensiveness, and the physiological/ subliminal perception paradigm explaining the *how* of defensiveness.

Psychology has tended to shy away from traditionally 'difficult' or 'messy' topics such as volition, consciousness, motivations and emotions in favour of apparently clear-cut and quantifiable (but sometimes rather trivial) topics such as lexical decision times, memory, and the verbal capabilities of infants (Kline, 1988b). It is possible that the 'scientific respectability' afforded by physiological interpretations of perceptual defence/vigilance attracts some researchers to this approach. So far as the present thesis is concerned, I prefer to think of perceptual defence or vigilance in operational or pragmatic terms - as differences in signalled awareness for emotional compared to neutral stimuli. The difficult question as to what mechanisms underlie the apparent perceptual defence/vigilance effect is outwith the scope of the present project.

Experimental techniques claimed to demonstrate perceptual defence/vigilance

Dixon (1981) has outlined five areas of research that claim to demonstrate real alterations in sensitivity to emotional stimuli. The methods used are: response bias subtraction, EEG correlations, rate of dark adaptation/sensory scaling, signal detection techniques, and closed loop control. The main characteristics and strengths and weaknesses of these techniques will be described below.

1. Response Bias Subtraction

Many of the earliest studies into perceptual defence/vigilance presented subject's tachistoscopically with emotional and neutral stimulus words and measured the stimulus duration/intensity at which subjects identified these words. These studies were often subject to criticism, however, as they failed to take into account various factors that could exert a confounding influence over the apparent ease of stimulus word identification. For instance, the higher the word-count frequency of the word, the lower the recognition threshold (up to a point) (Brown, 1961). So, early studies would compare recognition thresholds for, say, taboo words (which by definition are relatively infrequent) to thresholds for more frequently encountered neutral words. The raised thresholds that were often found for taboo words could not provide unequivocal evidence for perceptual defence because the two sets of stimulus words were not of equal frequency. Further, the most common source of information about word frequency that was used in subliminal perception studies is the Thorndike-Lorge word-count (1944), which is based on the frequency of words as they appear in written sources and which is intended as a guide to teachers as to what words they might most usefully teach their learner readers; it is quite possible that certain taboo words would be used more frequently, verbally, in some sub-cultures, and it is also quite likely that modern word usage has changed considerably since 1944.

A related problem for the early experiments was that subjects were required to vocalise the stimulus words to indicate stimulus identification. Again, these studies were criticised on the grounds that subjects might be more reluctant, consciously or unconsciously, to say taboo words out loud. Thus, it became necessary to develop methods to distinguish perceptual effects from response suppression or response bias effects.

Later studies tried to measure response behaviour in a no-stimulus situation, so as to get a measure of response bias, and then subtract that from the subject's total response performance. Typically, stimuli were emotional or neutral words presented in a tachistoscope, word emotionality being designated by the subject's reactions in a prior word-association test. There was an attempt to match the stimuli for length, structure, and frequency. Subjects were required to call out the words to indicate recognition. For instance, Mathews and Wertheimer (1958) claimed to demonstrate perceptual defence in their study 'A 'pure' measure of perceptual defence uncontaminated by response suppression'. Subjects were presented with a list of eight words (four emotional, four neutral) and were asked to identify these as they were flashed up singly at subliminal duration. In actuality, only four of the eight stimulus words were shown (two emotional and their matched neutrals). Calls of absent stimuli were considered to provide a measure of response bias which was then subtracted from the score of correctly called present stimuli. Mathews and Wertheimer found a remaining 'pure' perceptual defence effect.

However, this method of response bias subtraction does not necessarily imply an effect upon perception, and as such fails to give unambiguous support for the perceptual defence hypothesis. It is possible to interpret these findings in terms of a stimulus effect hypothesis, where the defence which is instigated by a stimulus occurs not in the perceptual system but in the response system; in other words, the stimulus may be exerting a specific effect on response tendencies (Natsoulas, 1965). (While it may be argued that such an effect on response tendencies may reflect defensiveness, the traditional definition of perceptual defence within the subliminal perception literature is restricted to perceptual or physiological interpretations as variations in the sensitivity of the perceptual threshold).

This ambiguity may be related to a problem with the method of response bias subtraction as it appeared in classical psychophysics in the guise of 'catch trials' that were intended to give a measure of chance success. Here, one takes the proportion of false-positive responses as an index of how much the proportion of correct-positive responses is inflated. Then, by subtracting, one is left with the proportion of 'true' positive responses. Signal detection theory showed that chance correction assumes statistical independence of false-positive and true-positive responses, and that this assumption was unjustified (Swets, 1973). It is unclear how serious an indictment this is for the method of response bias subtraction in subliminal perception, but it certainly suggests that the conclusions from research using such procedures should be treated with caution.

2. *EEG Correlations*

A second paradigm thought to demonstrate perceptual defence/vigilance involves examining changes in cortical activation as the subject observes a gradually strengthening stimulus. For example, Dixon and Lear (1963) presented a random series of emotional and neutral words onto a translucent screen (a large screen several feet away from the subject, rather than a small screen within a tachistoscope-like apparatus), with stimulus brightness increasing from near zero. Subjects were required to indicate (by pressing a button) the point at which they first became aware of seeing something on the screen (the awareness threshold), and then to indicate the moment they could recognise the word (the recognition threshold). A continuous EEG record was taken, and was later analysed in periods when there was no stimulus; periods between stimulus onset and reported awareness; and periods between the awareness and recognition thresholds.

It was found that defensive subjects, who took longer to report awareness for emotive than for neutral words, had more alpha abundance in the EEG record prior to reported awareness than vigilant subjects. Thus, the defensive subjects appeared to show depressed cortical activation prior to awareness. These findings (replicated and extended by Dixon & Lear, 1964, and Emrich & Heinemann, 1966, the latter cited in Dixon 1981; also see Shevrin, 1973, for a study of 'repressiveness' and averaged evoked responses) may indicate a physiological basis for perceptual defence: the cortex appears to be able to discriminate stimulus meaning (emotionality) prior to reported awareness and subsequently to influence the hypothalamus and ascending reticular activation system to enhance or depress cortical activation (the details of the neurological processes involved in perceptual defence/vigilance have been propounded by Dixon (1981) on the basis of neurophysiological studies on humans and other animals).

Of course, the recording of cortical activation with scalp electrodes is a particularly crude measurement of gross brain electrical activity. While EEG studies such as those reported above have been useful in providing some converging evidence that there is a physiological component to perceptual defence/vigilance effects, they are unlikely to be of great utility for detailed examination of the psychological processes involved in perceptual defence/vigilance. This is simply because there is insufficiently detailed information contained in EEG recordings for EEG-perceptual defence correlations to suggest meaningful hypotheses for further studies. Such physiological measures would, however, be of interest if they were taken in tandem with other indications of physiological state, such as the galvanic skin response as an indicator of autonomic arousal.

3. *Rate of Dark Adaptation/Sensory Scaling*

A few studies have been conducted on the assumption that if perceptual defence truly reflects physiological sensitivity rather than a response effect, then the rate at which an individual adapts to seeing in darkness may provide an index of threshold fluctuations (Worthington, 1964; Wallace & Worthington, 1970). It is difficult to be certain that perceptual defence influences dark adaptation itself rather than another aspect of physiological sensitivity, but such studies have examined individuals' subjective judgement of the relative brightness of emotional and neutral words presented below the recognition threshold. Worthington (1969) has also used a similar approach called sensory scaling which omits the emphasis on dark adaptation. Cooper & Kline (1986) used the method described by Wallace & Worthington (1970) in their evaluation of the DMT in relation to other measures of defences.

The original study by Worthington (1964) used the time taken for the subject to indicate awareness of the presence of white light in the visual field as the dependent variable. Stimuli were emotional and control words, that were projected individually at a brightness level that had previously been identified as that at which subjects could report the presence of light after a dark adaptation period of about 50 seconds. Subjects looked at bright lights for 2 minutes, then all lights were extinguished and the subjects' task was to look at the screen and indicate a) when there was the slightest impression of white light in the fixation area, and b) when the light could be reported with certainty. Subjects were unaware that the light was from verbal stimuli (that is, projections of words). After each stimulus presentation, subjects were light adapted again, and the procedure was repeated.

It was found that subjects took longer to report awareness of light produced by the emotive words than for the other stimuli. However, Worthington noted that these results, although demonstrating perceptual defence effects, failed to ascertain whether the stimuli were influencing subjects' rate of dark adaptation rather than differences in perception of individual light patches. A study by Barber and Mahotière (1982) that failed to replicate these findings criticised the experiment for allowing for unintentional experimenter cueing, and some subjects in the replication study were able to perceive that the stimuli were verbal. In reply, Worthington (1982) argues that Barber and Mahotière's study was not an exact replication, but admits there was a possibility of experimenter cueing in the original experiment. An earlier failure to replicate (Weintraub & Krantz, 1968) prompted Wallace and Worthington (1970) and Worthington (1969) to improve their methodology.

In the first of these studies, improvements were achieved principally by using a single test stimulus throughout the testing session. This was a nonsense shape presented in a series with either emotional words, words structurally similar to the emotional words, neutral words, nonsense shapes, or inverted emotional words. A second alteration was to use a more accurate measurement of psychophysical sensitivity. It was found that only when the test stimulus was presented in a series with emotional stimulus words did subjects take significantly longer to identify the test stimulus. As the same test stimulus was used throughout, differences in the apparent rate of dark adaptation (the time taken to register awareness) could not be attributed to differences in the actual light transmission between stimulus types. Wallace and Worthington (1970) concluded that this technique could reliably demonstrate that perceptual defence effects genuinely reflect differences in perceptual sensitivity rather than response bias effects.

It should be noted that the dark adaptation method is not a particularly simple way to study perceptual defence/vigilance. During the period of light adaptation it is important to ensure that all areas of the subject's retina are stimulated with equal amounts of light, otherwise it is possible that some will adapt more quickly to the dark than others, allowing glimpses of the nature of the stimulus earlier than intended. A quote direct from Wallace and Worthington (1970) conveys the elaborate measures which must be taken to ensure adequate light adaptation:

> The light adaptation apparatus consisted of two hemispheres, one encasing the other. The outer hemisphere had a diameter of 36 in., the inner, a diameter of 30 in. The outer hemisphere was metal and painted matt black. The inner hemisphere was bracketed on to the rim of the outer and was constructed of white translucent plastic. The plastic sphere was illuminated from behind by 10 100w. pearl lamps set in the metal sphere. The placement of these 10 lamps was such that at all points sampled on the inner sphere the intensity of illumination approximated 2.3 log. ft. lamberts...Attached to the outside rim of the plastic sphere was a piece of masonite painted matt black on the outside and white on the inside. In the centre of this piece of masonite was an opening large enough to

> accommodate the S's head. When the head was appropriately positioned the S's field of vision was restricted to the field of uniform luminance provided by the inner sphere. (p.42)

Wallace and Worthington do not report on the subjects' views on this methodology, but it seems unlikely that it was a pleasurable experience. The subjects placed their head within a sphere illuminated by 10 100w. lightbulbs for one minute. After this time, the lights were extinguished and the subjects swivelled round to place their mouth in a biteboard (to control the distance and positioning from the eyes to the screen). As the subjects were recently light adapted (some might say dazzled), the location of the screen had to be indicated by dull red lamps on either side. One wonders how the subjects managed comfortably to locate the biteboard in the dark.

It is likely that these experiments were unpleasant and stressful for the subjects. It is not clear why it was necessary to go to the lengths of designing an experiment looking at dark adaptation as an index of perceptual defence, especially since there was no prior evidence that dark adaptation was affected by perceptual defence. A more straightforward method would be to look at subjective brightness judgements at a constant level of background illumination. The sensory scaling approach described by Worthington (1969) implicitly admits this by dropping the dark adaptation emphasis from the design. Instead, subjects were required to scale pairs of faintly presented verbal stimuli of varying emotionality in terms of their subjective brightness, though objectively the brightness of the stimuli were identical.

There were two conditions in this sensory scaling experiment: in one, pairs of stimuli were presented simultaneously; in the other, the stimuli were presented successively, with a 10 sec. interval between the first and second members of a stimulus pair. Stimuli were projected at a level of illumination .1 log ft. lambert lower than that previously identified as the lowest required for stimulus word recognition. The only illumination was from the slides. Subjects identified which of the two patches of light was brightest, and were asked to guess if they could detect no difference. Subjects later reported no awareness that the stimuli had actually been words.

The rationale behind comparing successive with simultaneous stimulus presentation was that any response biases might be expected to appear in the simultaneous comparisons, but that in the successive comparisons only specific perceptual effects could be seen. In other words, in the simultaneous condition any sensory effects from emotional stimuli would be the same for both members of the stimulus pair, whereas in the successive condition the sensory effects could be different for the two pair members.

Results were interpreted as supporting the hypothesis that there is a physiological arousal component to perceptual defence, as only in the successive condition was it possible significantly to correlate the stimulus words' initial, conscious emotionality ratings with the subsequent brightness ratings.

It is not clear exactly how Worthington decided on the length of the period between the individual stimuli in the successive condition. As Worthington admits, the adoption of a 10 second interval is rather arbitrary: after consultation, he decided that 'it seemed likely that any 'arousal' change would be complete by 5 or 6 sec.' (Worthington, 1969, p.366), and 10 seconds was chosen to give a safety margin. Would a two second interval between the first and second member of a stimulus pair give different results? One wonders how the subject's memory (presuming there can be memory for items of which the subject claims to be unaware) interacts with the experimental design; or how a lingering shift in arousal would affect the results. While the sensory scaling approach seems methodologically superior to the dark adaptation paradigm, there is a need for further examination of the effects of different intervals between members of a stimulus pair on the subject's apparent perceptual sensitivity. This is therefore a promising method in general, but it needs some refinement so that some aspects of the methodology are less arbitrary.

4. Signal Detection Methods

Earlier, it was noted that much of the controversial history of perceptual defence/vigilance research has been characterised by attempts to ascertain whether apparent changes in the awareness for emotional stimulus material are due to response effects or to genuine changes in perceptual sensitivity. Signal detection theory (SDT) provides a method for identifying the relative contributions of response bias and perceptual sensitivity to an individual's decision to say whether or not a signal is present in a noisy background, and so is evidently relevant to the study of perceptual defence/vigilance.

A study by Dorfman (1967) on 'Recognition of taboo words as a function of *a priori* probability' illustrates the basic SDT paradigm. Sixty subjects were each allocated one of four word pairs for stimuli. The pairs each consisted of one taboo word (e.g. PENIS) and one neutral word (e.g. MIXER), equated for word frequency on the Thorndike-Lorge (1944) word count. Stimuli could be presented (via a tachistoscope) at three possible durations: 30, 50, and 70 milliseconds. Each subject was given four sessions of 200 trials each, and for each session the *a priori* probability for the taboo word was either .30, .50, .70, or .90, and the two words were each exposed for the same duration. Of the 200 trials in a session, 20% had blank stimuli; because the subjects were instructed to report one member of the word pair on each trial even if they felt they had seen nothing, this was a measure of response bias. Among the results, it was found that the probability of uttering a taboo word increased as its *a priori* probability increased. Dorfman was also surprised to note that, when response bias was accounted for, sensitivity was greater for taboo words than for neutral; that is, it appeared that the taboo words were more discriminable than the neutral words. Dorfman explained this latter finding as the effects of conditioned fear associated with the taboo words, as it has been suggested that conditioned fear increases the effective intensity of a stimulus. It might also be interpreted as perceptual vigilance due to increased physiological arousal associated with emotional stimuli (Dixon, 1981).

Signal detection theory renders obsolete the classical notion of fixed physiological thresholds; instead, an individual's report of whether or not a signal is present is considered to depend on several factors, such as the strength of the signal, the ratio of that signal to both internal (such as expectancy, level of physiological arousal) and external noise levels, the instructions given to the subject, and the cost or benefit the subject will receive upon correctly identifying the presence of the signal. For instance, if subjects are told they will receive a painful electric shock each time they fail to report the signal's presence, they are likely to say 'yes' all the time, to avoid the risk of punishment. The decision on whether or not to report the signal as present is therefore seen as composed of two factors: the subjects' sensory sensitivity (d'), and their response bias or criterion (β). The mathematics of SDT allows the computation of d' and β, so SDT would be well suited to distinguish between response bias and sensitivity components in perceptual defence.

Given this relevance, it is surprising that few researchers have taken advantage of SDT methods to study perceptual defence/vigilance. This reticence is even more surprising when it is found that those studies which *have* applied SDT to perceptual defence have found results favouring the perceptual sensitivity hypothesis over the response bias hypothesis (Hardy & Legge, 1968; Broadbent & Gregory, 1967; and, as mentioned earlier, Dorfman, 1967).

Hardy and Legge (1968) conducted two experiments to test the hypothesis that emotional stimuli presented below awareness in one sensory modality would produce higher awareness thresholds for neutral stimuli presented in another sensory modality. The first experiment found awareness thresholds for neutral visual stimuli to be significantly higher during the subliminal auditory presentation of emotional stimuli. The second experiment reversed the experimental roles of the two sensory modalities, and analysed the performance in terms of SDT. Over a total of 64 trials per subject, subjects were required to rate their confidence that a neutral auditory signal had been presented, while simultaneously neutral or emotional words were presented visually at a subliminal level. If sensitivity (d') was lower during emotional stimulation than during neutral stimulation, then this would suggest that a reduction in sensory sensitivity raised detection thresholds. On the other hand, if response bias (β) was higher during emotional than neutral stimulation, this would suggest that emotional stimuli decreased the subjects' willingness to report the presence of a signal, thereby raising detection thresholds.

Pooling the data from all subjects, Hardy and Legge found a d' of 1.73 SD units during neutral subliminal visual stimulation, and 1.07 SD units during emotional subliminal visual stimulation. Therefore, the lower d' values during emotional stimulation indicated a decrease in the sensitivity of the perceptual mechanism. (Incidentally, the finding that subliminal stimulation in one sensory modality influences awareness for a stimulus in another sensory modality provides support for Dixon's argument that central rather than peripheral brain mechanisms are involved in perceptual defence/vigilance.)

Broadbent and Gregory (1967) examined the question of how much word frequency effects and response bias contribute to the apparent changes in awareness thresholds for emotive words. An earlier study by Broadbent (1967) identified that it was problematic to use SDT mathematics in cases where different responses have different biases attached to them, as is the case when using high-frequency and low-frequency (e.g. taboo) words as stimuli. However, an approximation to SDT methods was obtained using Luce's (1959) choice theory adaptation of SDT mathematics, and this was applied to the perception of words of different degrees of emotionality.

In summary of a complex procedure, Broadbent and Gregory established how many errors were made in each class of emotional quality (good, neutral, bad), to each class of stimulus (good, neutral, bad), for high frequency and then for low frequency words. They then compared the ratios they found with those predicted by a random sample from the Thorndike-Lorge Word Count (1944). While the ratios were very similar, there was a significantly worse error performance for the emotional versus the neutral words.

Broadbent and Gregory concluded that emotional words did not behave like words of low probability. Instead, there appeared to be a failure of the stimulus information actually to reach the perceptual mechanism, so that in terms of the relevant SDT parameters, the effect of emotional words was on d' not on β.

We can see that SDT has been usefully applied to distinguish perceptual from response bias effects in perceptual defence/vigilance. It is unclear why these findings have not been followed up. There are, however, several arguments against using signal detection methods in the experiments planned for this thesis; these will be discussed in the concluding section of this chapter.

5. Closed Loop Control

This method was pioneered by Dixon (1958a, 1958b) in an attempt to overcome the ambiguities of earlier studies of perceptual defence/vigilance. These ambiguities were largely caused by the typical experimental paradigm: 1. the use of tachistoscopic presentation could cue the subjects as to when the stimulus was being exposed; 2. the stimulus material had three roles: 'it is that which affects the threshold for phenomenal representation of itself, that which is represented, and that by which such representation is reported' (Dixon, 1981, p.140); and, 3. the use of verbal report as a signal of recognition was rather far removed from the earlier stages of sensory processing.

Recent experimental support for this third point was reported by Marcel (1990) in an unpublished paper presented at a conference on 'The Phenomenal Mind'. Subjects were required to indicate whether a light had flashed by three separate response modes: eyeblinks, button-presses, or verbal responses. It was found that subjects showed most accurate discrimination when their response was given in the form of eyeblinks; button-presses were slightly less accurate, and verbal responses showed the poorest discrimination performance. Though he was unable to make any firm conclusions on the meaning of these findings, Marcel noted that they called into question the assumptions that:

> (a) such responses are functionally equivalent as reports referring to phenomenal experience; (b) that reports cannot affect the experience reported; (c) that phenomenal experience is unitary. (p.2)

As a remedy to the ambiguities of some earlier studies of perceptual defence/vigilance, Dixon argued for the use of awareness rather than recognition thresholds, as the former would be expected to fluctuate if perceptual defence/vigilance effects are sensory in origin. Also, the report of awareness is independent of stimulus content, thus removing the response biases associated with word familiarity, word preferences, and expectancy or set, that had been a weakness of earlier studies. Further, the use of awareness thresholds circumvents possible ethical objections against subjects consciously seeing and even having to say words which may be disturbing or embarrassing to them.

The closed loop control methodology achieves these improvements by presenting stimuli at subliminal intensities to one eye while recording concurrent changes in sensitivity for a neutral stimulus presented to the other eye. An example of how this worked in practice is seen in an experiment by Henley & Dixon (1976). Emotional and neutral verbal and pictorial stimuli were projected individually to the subject's right eye at an intensity 0.3 log. unit below the previously identified awareness threshold for two neutral stimuli (one verbal, one pictorial). At the same time, a spot of light was projected to the left eye. Subjects (in this experiment, male schizophrenics) were aware only of the presence of the spot of light, and were asked to raise and lower the brightness of the spot so that it kept appearing and disappearing, over a period of 30 seconds (for each stimulus exposure). Left spot brightness provided a measure of perceptual sensitivity such that if the subject was perceptually defensive to the emotive stimulus then the spot would appear to the subject to become dimmer, so that he would adjust the spot to be brighter; and if the subject was vigilant, the spot would appear brighter and would be adjusted to a dimmer objective intensity. The results of this study found that the thresholds for the spot of light varied significantly as a function of the concurrent subliminal stimulation. For instance, mean spot brightness for the word 'BREAST' was significantly higher than for 'RECANT', indicating perceptual defence to 'BREAST'.

There are, however, possible methodological weaknesses in this experiment. Each subject was presented with the stimulus slides in a different order, and the authors claim that the experimenter remained blind as to the slide order until the end of each trial because 'luminous dots on one corner of each slide made it possible for them to be shuffled, and placed in the apparatus the correct way up without the experimenter ever having to be aware of their content' (Henley & Dixon, 1976, p.163). This procedure may be criticised on two counts. Firstly, hand shuffling is an inadequate method of randomisation; and secondly, researchers familiar with the phenomenon of perception without awareness should realise that it is quite possible that the experimenter could have perceived very faint cues as to the nature of each slide, despite being completely unaware of having seen anything, and could then have unconsciously cued the subject as to the nature of the stimulus material. While this latter problem may seem unlikely to exert much influence on the experimental findings, it would be wise to remove even the faintest possibility of subliminal perception and unintentional cueing on the part of the experimenter.

One may also criticise one of Dixon's claimed advantages of the closed loop control design - the separation of input and output channels: 'one eye receives the subliminal stimuli, the other provides a measure of threshold change' (Dixon, 1981, p.141). But this advantage is more apparent than real due to the physiology of the visual system: whereas many of the body's functions are represented contralaterally in the brain (for example, motor control for the right hand is located in the left cerebral hemisphere), the information from each of our eyes is projected to both cerebral hemispheres. Visual information from the right half of the retina of the left eye and the right half of the retina of the right eye (known as the right visual field) project, via the optic chiasma, to the visual cortex in the right cerebral hemisphere, and vice versa for the left visual field. It is only at the visual cortex that higher level processing of the visual information occurs at a level where meaning may be attributed to the physical impulses generated by the visual information.

What this means for Dixon's method is that although input and output channels are separate outside the subject's body, they are combined very shortly after the visual information stimulates the cells of the retinas. For

Dixon's design to approximate a separation of input and output channels, the visual information would have to be projected to each visual field separately. Because Dixon did find perceptual defence and vigilance effects quite reliably with this technique, yet the information from the right and left eye combine early in the processing of that information, this suggests that it is not necessary to project stimuli to separate eyes.

There continue to be major advantages to Dixon's design, however. Although he did not keep input and output channels physiologically separate, it is a great strength to have awareness for a concurrent meaningless neutral stimulus as an index of sensitivity to a subliminally-presented meaningful stimulus. The functional separation of the roles of the two types of stimuli helps to eliminate many of the problems associated with earlier studies of perceptual defence.

Conclusions

In order to compare defensiveness and psi, it was firstly necessary to review the different ways that defensiveness has been defined and measured in the past. It was felt that the subliminal perception paradigm would be best suited to the aims of this thesis: perceptual defence and perceptual vigilance are defined quite precisely; they may be measured quantitatively; and subjects may be quite unconscious of their differential reactions to the subliminal stimuli, so that there is less likelihood that conscious motivations or response strategies will influence subjects' reactions.

Chapter 2 reviewed the DMT-ESP studies that compared individuals' DMT scores with their performance on psi tasks using neutral targets. It was noted, in passing, that the author of the first DMT-ESP study speculated that the DMT-ESP correlation might be even stronger if emotional ESP target material was used (Carpenter, 1965). Implicit in this idea is the assumption, that is appealing to me, that by increasing the similarity between the defensiveness and the psi testing situations one might boost the defensiveness-psi relationship, perhaps because one is increasing the chances that the subject will react similarly to two similar situations. Therefore, a consideration of different subliminal perception methods, should include their suitability for matching closely with psi testing methods.

This chapter reviews five different experimental paradigms that have claimed to demonstrate perceptual defensiveness or vigilance to emotive stimuli: response bias subtraction; EEG studies; dark adaptation/sensory scaling; SDT methodology; and closed loop control. Each methodology has its particular strengths and weaknesses that make it more or less suited to the aims of the this thesis; from a practical point of view, especially, it was hoped to identify a *simple* yet effective technique for identifying individuals as perceptually defensive or vigilant. Response bias subtraction, EEG techniques, and brightness scaling methods seemed less promising than SDT and closed loop control techniques.

The method of response bias subtraction, while improving on earlier studies, fails to give unambiguous evidence that the stimulus affects perception *per se* rather than response tendencies. EEG studies demonstrating changes in cortical arousal prior to reported awareness provide converging evidence that defensiveness/vigilance effects are related to central brain mechanisms rather than response systems. However, the crude nature of EEG measures makes the development of further process-oriented studies difficult. Dark adaptation methods seemed cumbersome and stressful to the subject, but the more elegant sensory scaling approach contained some rather arbitrary assumptions which require further examination.

Although SDT methods have been successfully applied to the study of perceptual defence/vigilance, it is felt that these methods are less amenable to the comparison of defensiveness with psi scoring. One of the aims of this thesis is to compare, *as directly as possible*, subjects' performance on a subliminal perception task with their performance on a psi task. In order to allow a close comparison, the two tasks require to be as similar as possible, so SDT-like methods would need to be applied to each. The signal detection paradigm requires literally hundreds of trials per subject in order to get a reliable measure of sensitivity and criterion. One can, like Hardy and Legge (1968), pool data from all subjects to get a single measure of d' and β, so that each subject may conduct fewer trials. However, this method washes out individual differences in sensitivity and response bias to give only a gross measurement; if some subjects were perceptually defensive and others perceptually vigilant, these would cancel each other out. Using a similar methodology for a psi task, with hundreds of trials, subjects would quickly succumb to boredom and fatigue - psychological conditions that are not thought to be 'psi-conducive'. So the use of SDT methods would not appear to facilitate the comparison of SP with ESP performance, unless the ESP task is modified into a form that would not be expected to encourage good ESP performance.

A second problem with the use of signal detection methods is that they simply cannot account for psi-missing - scoring below chance expectation in an ESP task. In their guide to the application of SDT, Pastore and Scheirer

(1974) advise that there can be only two possible explanations for a subject scoring below chance:

> measurement error or...the subject performing the discrimination and then emitting a response that is inconsistent with the computed decision statistic...If a subject consistently produces data that fall below the chance line, there is justification to assume that the subject can perform the discrimination, but is malingering (p.951).

Thus, the apparent anomalous phenomenon of psi-missing cannot be accounted for within the theoretical framework of SDT. Yet psi-missing can and does occur in parapsychological experiments, and psi-missing is an important component of the defensiveness-psi relationship since, as chapter 2 showed, perceptually defensive individuals tend to psi-miss and perceptually vigilant individuals tend to psi-hit.

A final argument against using SDT methods in this thesis is that they are perhaps of greatest utility in disentangling the processes which underlie perceptual defence effects, especially the different contributions of perceptual sensitivity and response bias to perceptual defence effects. While this is an intriguing question, it is outwith the remit for the current project, which must restrict itself to an attempt to replicate conceptually the DMT-ESP findings, and to look at target and personality variables as they relate to the ESP process. As it is conceptualised within the subliminal perception literature, perceptual defence is regarded (as the word 'perceptual' suggests) as a physiological phenomenon, related to fluctuations in arousal and corresponding threshold fluctuations at the stage of *perceptual input*. Response bias effects do of course act upon reports of perceptions, but these are regarded as peripheral in the relatively narrow definition of perceptual defence and vigilance within the subliminal perception tradition.

Dixon's method of closed loop control has several distinct advantages over the other techniques, but it is unnecessarily complex. Were it not for this complexity, other researchers might have adopted the closed loop control technique. For instance, Cooper (1982) had intended to construct a similar apparatus for his experimental investigation of perceptual defence, but reported that 'this project had, unfortunately, to be abandoned because of the unavailability of the optical equipment (and expertise) required to engineer this rather complex apparatus' (p.175). As it is, the encouraging findings of those studies which have used this equipment have not been followed up. Today, Dixon's apparatus lies unused in a basement of University College London and is considered to be largely obsolete (personal communication with Jim Chambers, Chief Technician at University College, London). For this thesis, it is proposed to develop a methodology which adopts some of the basic strengths of the closed loop method while improving and modernising other aspects of the design; the next chapter develops this point in more detail.

Chapter 4. The development of an improved methodology for the study of perceptual defence/vigilance.

Chapter 3 found that none of the reviewed methods for demonstrating perceptual defence was completely satisfactory or suitable for the purposes of this thesis. In devising a methodology for experiments in this thesis, it is hoped to retain or even improve upon the positive aspects of Dixon's closed loop method, while dropping its unhelpful or unnecessary components. An unpublished undergraduate thesis on perceptual defence by Peter Gregor, a psychology student at the University of Edinburgh (1972, supervised by John Beloff), describes a simple method to study perceptual defence/vigilance effects that goes some way to this end. This chapter firstly describes Gregor's original apparatus, then points out difficulties with this methodology, and finally describes the development of a methodology for indicating perceptual defence/vigilance that seeks to overcome the flaws in Gregor's method.

Introduction to Gregor's Apparatus

This apparatus, consisting of a modified tachistoscope (known as 'Pandora's Box'), presented both the subliminal stimulus and that which was used to serve as an index of threshold to both eyes. The two-field tachistoscope presented the subliminal and threshold stimuli at a gradually increasing brightness, so that the dependent variable was stimulus intensity rather than stimulus duration. One field of the apparatus was constantly illuminated, and the subject's task was to discriminate the gradually brightening stimulus from an already illuminated background field, rather than to detect the presence of light against a background of darkness. Therefore there was no need to ensure that the subject was dark adapted.

The half-silvered mirror within the tachistoscope caused the stimulus slide, as it gradually brightened, to appear to emerge as a brighter area at the centre of the background field. Six of the stimulus slides in Gregor's experiment portrayed structurally similar emotional or neutral words, and there was also a dual-purpose blank slide for initial identification of the subjects' awareness thresholds and to demonstrate the task to the subjects, and a nonsense pattern structured like a word, but not constructed of real letters. As the intensity of the stimulus slide gradually increased, the first thing that became visible to subjects was a brighter rectangular patch, representing the area of the transparency and its boundary with the cardboard mounting. If the illumination of the slide was increased further, Gregor reported that a lighter patch gradually became apparent at the centre of the rectangular patch, and as intensity increased this could eventually be identified as a word.

Gregor used the illumination level at which subjects became aware of the larger rectangular patch of light as the awareness threshold. This dependent variable was neutral, and as the experiment was apparently conducted so that subjects were never aware of the nature of the subliminal stimuli, this design circumvented response bias and expectancy criticisms.

Subjects were presented first with the blank slide, so that a 'safe' upper intensity level could be identified beyond which the stimulus slides would not be illuminated so as to ensure that subjects were never at risk of identifying the nature of the verbal stimuli. Each of the seven stimulus slides was presented 3 times in a random series, with the intensity being gradually increased until subjects pressed a button to indicate awareness of the rectangle. Gregor measured the awareness thresholds for each stimulus. The button press returned the illumination of the stimulus field to zero, and after a variable time interval the next trial was initiated. The variable time interval between trials was intended to ensure that subjects did not become sensitised to the length of time it would take before awareness. A control group was run with an identical procedure, except that each slide was presented reversed and upside-down. This provided a check on whether any differences in sensitivity for the emotional versus the neutral slides were really due to the slides' different meaning, rather than simply being due to differences in the amount of light transmitted by the two classes of slide.

It was found that two of the three emotional words produced significantly raised awareness thresholds as compared to their matched neutral words. That is, subjects required a higher level of illumination before they reported awareness of the rectangles. These findings could not be attributed to structural differences between the emotional and neutral stimuli nor to any response suppression as during the experimental phase subjects never reported awareness of the nature or even the existence of the subliminal stimuli. However, the nonsense slide showed the highest thresholds of all, a finding that Gregor was unable to explain. Possibly, the words were reacted to more quickly than the nonsense slide because the words were more familiar and therefore more readily recognised (even unconsciously) than the nonsense slide; less likely is the possibility that subjects found the nonsense slide to be more emotional than the word slides.

Weaknesses of Gregor's Study

Gregor claimed to have demonstrated perceptual defence effects using a relatively simple apparatus that incorporates the main strengths of Dixon's method, notably the use of awareness rather than recognition thresholds, and with the subject reporting awareness of a neutral, non-meaningful stimulus without explicit reference to the subliminal stimulus. It would, however, be possible to improve upon Gregor's apparatus: most of the methodological flaws are linked to manual stimulus presentation, manual control of the apparatus, and manual recording of results.

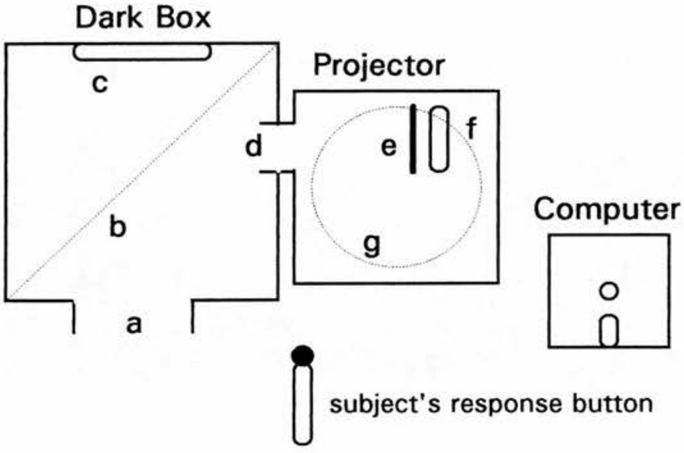
Although some precautions were taken to lessen the chance of the experimenter becoming aware of the nature of the stimuli and then unintentionally cueing the subjects, manual slide insertion remains a weakness in the design. The experimenter also increased the illumination of the slides manually and there is a possibility that he did not do this identically for each subject. The experimenter also manually recorded the intensity at which each subject registered awareness of the rectangle, and it is possible that some errors could have been made with this procedure. Furthermore, as the experimenter was not blind to the subject's responses, he might have unintentionally cued the subjects so as to reinforce the signs of perceptual defence that they may have been showing. The inter-trial intervals were meant to be varied so that the subjects could not begin to estimate the time taken until awareness, but the experimenter varied these intervals according to his own judgement. It is unlikely that the inter-trial intervals were truly random, since humans are notoriously poor at judgements about randomness (e.g. Lopes, 1986).

An improvement would be to automate the procedures for stimulus presentation and recording of results. This would remove any likelihood of experimenter cueing, it would standardise stimulus presentation, and it would reduce the likelihood of error or bias in the recording of subjects' responses.

Modification and Computerisation of Pandora's Box

Gregor's methodology appears basically simple and sound; it includes the main strengths of Dixon's closed loop control method, while being methodologically uncomplicated. For a second opinion on this conclusion, and in order to devise improvements on the weaknesses I identified, I sought technical advice from Mr Jim Chambers, Chief Technician at the Psychology Department of University College, London. Mr Chambers has over 20 years' experience in the construction of apparatus for presenting subliminal stimuli, notably through his work with Norman Dixon. Possible improvements to Gregor's apparatus were considered. The 'remains' of Pandora's Box (that had apparently already been 'cannibalised' for spare parts over the years) were located in the Psychology Department of the University of Edinburgh, and the modification of Pandora's Box was turned over to technicians in that department, who were able to refer to Mr Chambers for specialist advice where necessary. Geoff Baldwin was principally responsible for the circuitry and James Duncan machined new parts.

Figure 4.1
The Modified 'Pandora's Box'



Key:
a - subject's viewer
b - half-silvered mirror
c - constantly lit electrolum. panel
d - entrance for slide image
e - slide
f - variably lit electrolum. panel
g - carousel slide tray

1. *Overview of the Apparatus*

Figure 4.1 illustrates the basic components to the modified and computerised apparatus that was developed as an indicator of perceptual defence/ vigilance.

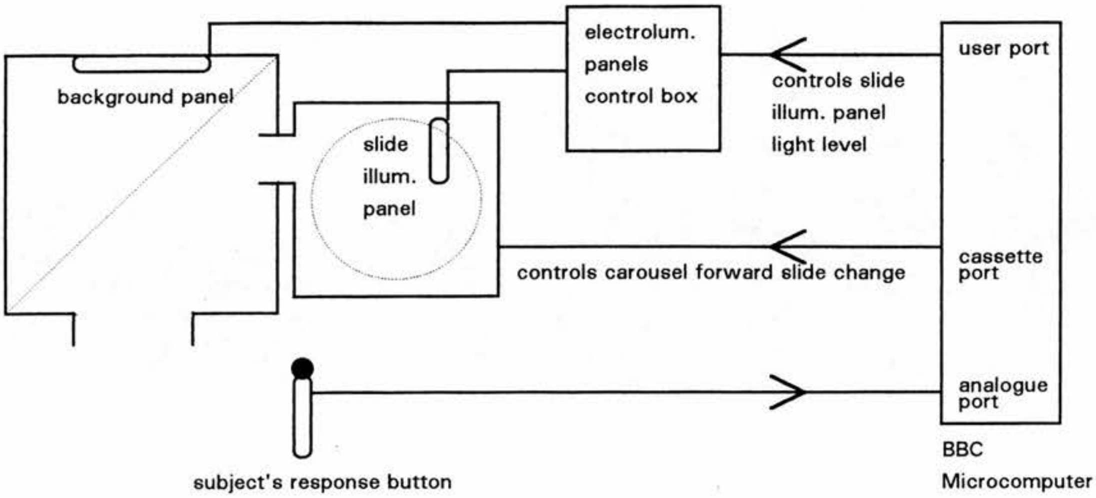
As is shown in the figure, the main component of Pandora's Box is a modified two-field tachistoscope, with a constantly lit light source forming one field (marked 'c' in the figure), a slide projector ('e') forming the other field, and a half-silvered mirror ('b') that superimposes the two fields. A BBC computer ('h') controls slide presentation and brightness, and records the subject's button-press ('i') response to each slide. The following section describes the apparatus in greater detail.

2. *Development of the Apparatus*

The basic tachistoscope was modified and modernised so that a constantly illuminated electroluminescent panel (see section 3 below for details) measuring 6"x4" formed the background field (marked 'c' on the figure). The second field, that would contain the stimulus slides, was removed and replaced by a black piece of plastic with a circular hole in it. In order to automate stimulus presentation, a Kodak Carousel projector ('e') formed the second field. The projector's lenses and usual light source were removed and a second, smaller electroluminescent panel (2"x3.5") (marked 'f') was fitted into the projector just behind the slide cradle. Therefore, both the background field and the stimulus field were illuminated by electroluminescent panels. A metal cylinder, painted matt black, was inserted into the projector in order to cut down on extraneous light from the electroluminescent panel that, at high illuminations, tended to reveal the passage between the slide cradle and the outside of the projector. The hole in the side of Pandora's Box was almost identical in diameter to the metal cylinder that projected about 0.5 centimetres from the projector. The cylinder opening was placed against the hole in Pandora's Box ('d') (the two were separated by a thin plastic magnifying lens that was introduced as a result of preliminary investigations that showed the unmagnified slide to be difficult to see when fully illuminated) so that virtually no light could enter Pandora's Box except from the light source within the projector that formed one of the fields of the apparatus, from the background field of the apparatus, and from the aperture through which the subject looked. As, during use, background lighting was extremely dim and subjects were asked to place their faces close to, or touching, the shaped viewing mask, it is thought that very little extraneous light could enter Pandora's Box.

The electroluminescent panel ('f') within the projector could be increased in brightness in a series of 99 discrete steps from darkness, so that in this application a slide could be gradually brightened. The two fields were

Figure 4.2
General wiring layout for the modified Pandora's Box



effectively blended via the half-silvered mirror ('b'). Thus, as a slide was gradually increased in intensity, this appeared to the subject as an area in the centre of the background field that gradually brightened, took on a rectangular shape (the overall shape of the transparent part of the slide) that continued to brighten gradually until, approaching full illumination, the contents of the slide could be recognised.

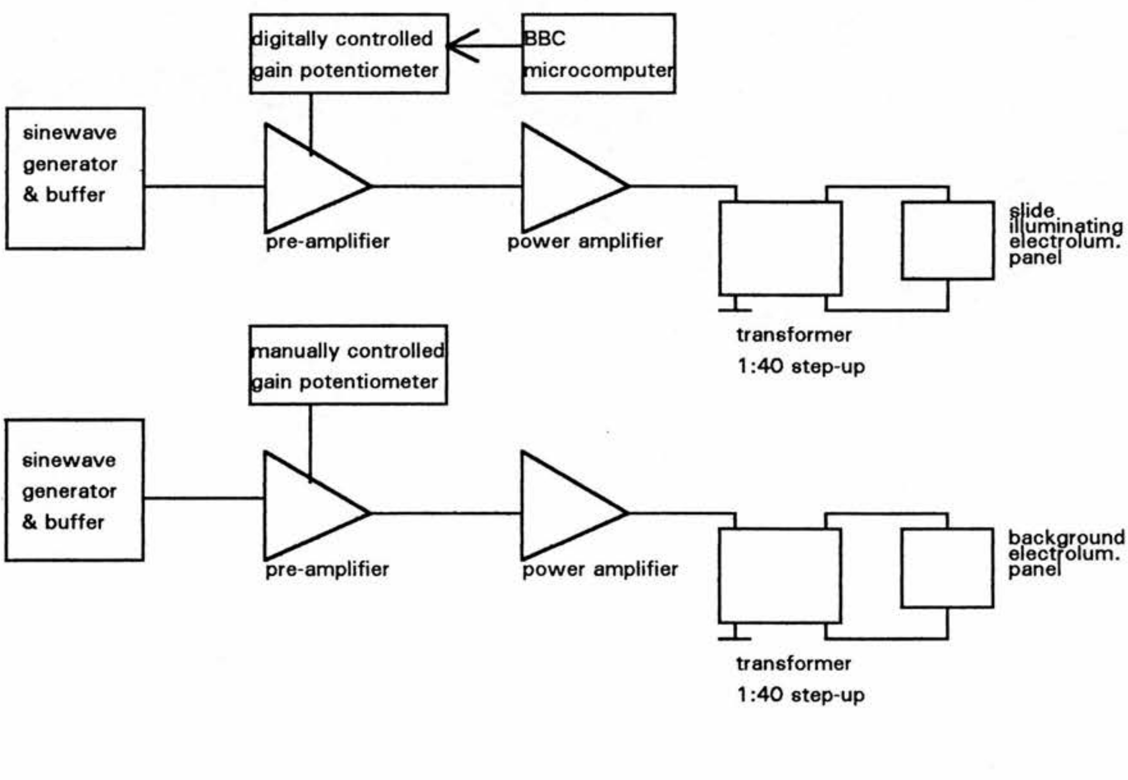
Figure 4.2 shows how the components of Pandora's box were connected to one another.

3. Details of the Light Source Used

The 'Kard-O-Lite'™ electroluminescent panels (produced by Bonar Kard-O-Lite, Inc., King of Prussia, PA 19406, USA) emit light when energised with an a.c. supply voltage. The light frequencies that are emitted do not change with voltage (unlike conventional filament light sources) nor is there a critical voltage below which light is suddenly not emitted (unlike fluorescent light sources).

The circuit controlling the electroluminescent panels, shown in figure 4.3, was designed by Edinburgh University Psychology Department Technician Geoff Baldwin to give a variable voltage range of about 25 to 115 volts a.c. at 400 Hz. Full technical details of this circuit are reproduced in Appendix 1. The smaller of the two panels, in the slide projector, has its applied voltage, and thus its light output, controlled by signals from the BBC microcomputer. The larger panel, within Pandora's Box, has its applied voltage controlled by a manually operated potentiometer. The background panel, that could in principle be varied in brightness, was manually set so that

Figure 4.3
Schematic drawing of electroluminescent panels control circuit



the illumination by the panel measured approximately 9 lux (this illumination figure was estimated through a procedure described below under the heading 'monitoring light output from electroluminescent panels'). At this setting, the panel was dim but visible and provided constant background illumination, therefore obviating the need for subjects' eyes to be fully dark adapted during experiments.

Circuit Operation

With reference to figure 4.3 (the electroluminescent panels control circuit schematic drawing), the sinusoidal a.c. voltages required by the two panels are generated by two Waveform Generators, Type 8038. The output frequency, in both cases, is set by the resistor/capacitor combination to be approximately 440 Hz. The potentiometer/resistor networks connected to terminals 1 and 12 of the waveform generators are used to remove any sinewave distortion.

The output of each generator is buffered by a voltage follower, part of a Quad Operational Amplifier LM324, whose output is fed to a voltage divider resistor network which reduces the signal amplitude to approximately $1/200^{th}$ of its original value.

The projector light source panel pre-amplifier has its gain set by a Digitally Controlled Potentiometer, Type X9503 (see appendix 2 for full operational details). This potentiometer has 99 discrete steps over its full range of 50 K Ohms, and, together with the resistor values chosen, enables a gain variation of from x1.5 to x6.5.

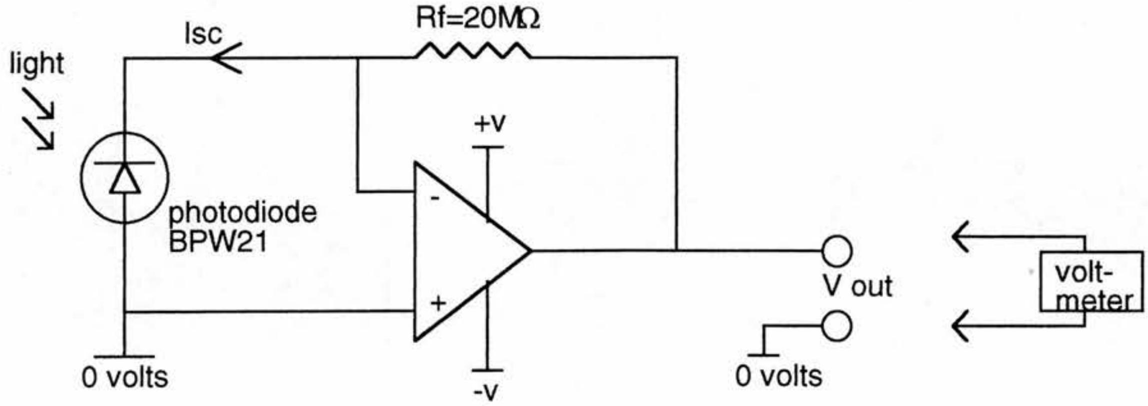
The 5 watt power amplifier is of a standard audio amplifier configuration with a gain of x100 and supplies the voltage winding of a step-up transformer with a turns ratio of 1:40. Full technical details of this amplifier are provided in appendix 3.

Monitoring light output from electroluminescent panels

It was considered necessary to try to have an objective measure of light output in standard units such as lux so that other researchers could gain an idea of the illumination conditions used in this experiment. Also, the typical life of an electroluminescent panel is given as half initial brightness after running for 1000 hours at nominal recommended luminosity. The technician who fitted the panels felt that as they would be used at very low levels of light output, the decrease in light output with time would be much less than the typical value. However, I felt it was still necessary to be able to check the light output from the panels periodically, to ensure that lighting conditions throughout the experiments conducted for this thesis would be constant, or that any decrement in brightness over time would be detected.

The technicians had great difficulty in finding a sufficiently sensitive measure of illumination intensity that could discriminate between the 99 incremental steps in intensity caused in the smaller panel by varying the applied voltage. In the end, a photodiode (i.e. light sensitive) Type BPW21 and a current-to-voltage conversion circuit were mounted on a slide-sized board. These could be positioned in place of a slide within the projector to measure the light intensity as it reached the slide. With the system fully connected, the panel could be put through its 99-step range and at each step the voltage applied to the panel could be noted as well as the voltage output from the current-to-

Figure 4.4
Calibration circuit converting illumination to volts



V out = IscRf
Isc=EvSk

Where

V out=signal output voltage, volts
Rf=feedback resistance, ohms
Isc=photodiode short circuit current, amps (A)
Ev=incident illumination, lux
Sk=photodiode sensitivity, A/lux

voltage converter. Tables completed during the testing of the system when first built could be used to compare results and would show changes in light output, if any. See appendix 4 for tables produced during initial calibration of the apparatus in August 1989, prior to any experimentation with Pandora's Box, and in November 1990, in the middle of the experimentation period. It will be seen from appendix 4 that no significant change was found in the light output of the stimulus slide electroluminescent panel (this was expected, since the light output from this panel was very low in these experiments, thus considerably extending the expected life of the panel).

Figure 4.4 shows the calibration circuit that was used to convert the illumination from the stimulus electroluminescent panel to volts. Monitoring the light output from the stimulus electroluminescent panel by the photodiode, a voltage output is obtained which may be related to incident illumination (lux) through the following equations:

$$\text{Voltage output, } Vo = IscRf \qquad (1)$$

$$\text{and } Isc = EvSk \qquad (2)$$

Substituting for Isc in (1)

$$Vo = EvSkRf$$

$$\text{and } \therefore Ev = \frac{Vo}{SkRf}$$

The value of Rf is 20×10^{6} ohms

and Sk is *typically* 7 nA/lux (nanoamps/lux)

$$\therefore SkRf = 7 \times 10^{-9} \times 20 \times 10^{6}$$

$$= 0.14$$

$$\therefore Ev = \frac{Vo}{0.14} = Vo \times 7.14 \text{ lux}$$

In other words, one can *estimate* the incident illumination for the stimulus slide in Pandora's Box by converting the voltage produced by the light sensitive diode (whose circuitry is illustrated in figure 4.4) to lux, using the above formula. It should be stressed, however, that any lux value calculated using these methods is only an approximation, since the level of illuminations being used are so low that it is difficult to measure them without highly specialised equipment.

4. The role of the Computer

Before choosing to work with a modified tachistoscope for stimulus presentation, I considered the use of a computer to present stimuli, and consulted an expert in this method, Mr Chambers, for his opinions. He saw several problems were a VDU to be used in the way I had in mind. Most importantly, there was little fine control over screen brightness with the VDU. Secondly, the relatively slow scanning speed on a VDU screen meant that, effectively, the stimulus was being presented sequentially (that is, revealed in a sequence from the top to the bottom of the screen) rather than the whole stimulus being shown simultaneously. This latter problem could be overcome by using a vector oscilloscope, but this solution was prohibitively expensive. It was therefore decided that using tachistoscope-like methods would give more control over stimulus presentation and illumination than a VDU. However, a BBC microcomputer is constructed to allow it to interface with many auxiliary facilities and this makes it an ideal 'workhorse' for the automation of the proposed methodology.

The BBC computer changed slides, controlled the illumination of the electroluminescent panel in the projector, and recorded to disc the brightness step at which the subject responded to each slide. In order to make the BBC fulfil these functions, a program was written in BBC Basic. Dr Hamish Macleod of the Psychology Department kindly wrote a 'skeleton' program, that I then expanded and adjusted to fit the experimental requirements. The main features of this program are noted below (and see Appendix 5 that gives, for illustration, the program used for Experiment 7).

When the program was run, it took the brightness of the projector illumination down to zero, then changed a slide. The program then paused for a random length of time (no more than 10 seconds, chosen with the BBC Microcomputer's RND function, that uses a pseudorandom algorithm) before beginning to brighten the projector panel, thus gradually illuminating the slide. At each (approximately equal) brightness increment, the program checked to see whether the subject had pressed the response button. If the button had been pressed, the panel brightness was returned to zero and the next slide was presented, again following a random time delay. If the button was not pressed, the computer paused for one fifth of a second before stepping the brightness up another increment and again checking for whether the subject had responded. The pause between each brightness increment effectively controlled the speed at which the slide appeared to brighten.

For the first five 'practice' slides, the subject changed the slides manually by pressing the response button. The response to the fifth of the practice slides was used to set a maximum upper brightness limit for all subsequent stimulus slides (this was to ensure that the slide could not accidentally be illuminated to the point at which the subject could begin to discern the contents of the slide). This limit was set by programming the computer not to brighten future slides beyond 10 increments above the level at which the subject responded for the fifth practice slide. The figure of 10 extra increments was chosen because it allowed room for some variation in subjects' responses, but avoided any danger of brightening the slide too far (as inferred from subjects' verbal reports of seeing nothing of the slide contents and, as discussed below, based on observations of typical levels of responding).

The results for the five practice slides (that would not be analysed) were displayed on the BBC VDU, to enable the experimenter to check that the subject was responding in a typical fashion and that the maximum limit was 'safe' (that is, within the range that preliminary investigations had suggested maintained the subliminality of the slide contents). The typical range of scoring in any one experiment could vary depending on the nature of the stimulus slides, and on the instructions to participants regarding the response criterion that they were required to adopt. For instance in experiment 3, for slides that were dark in the background with the stimulus information portrayed in light lines, and where participants were asked to respond not when they first saw light indicating the presence of the stimulus slide, but when that light assumed the rectangular shape of the transparency, scores typically ranged from about 45 to about 55 brightness steps. Also in experiment 3, and again using the 'rectangular shape of light' response criterion, for slides that were light in the background and displaying the stimulus information in dark lines (as used in all other studies in this thesis), the typical range of responding was from about 28 to about 38 brightness increments. For experiment 6, where participants were asked to let the slides brighten until they could begin to see the *contents* of the slides (that is, to see lines, shapes, blotches, even if they could not be recognised as meaningful), the average brightness score was around 48. This was in accordance with my preliminary explorations of how bright the slides had to get before any stimulus information was seen, and so it is felt that by setting a ceiling of 10 brightness increments over the participant's average level of responding, the slides may not brighten sufficiently for the participant to perceive any helpful cues about the stimulus nature.

Although, for the reasons just discussed, participants' brightness scores for the practice slides were displayed on the experimenter's computer screen, the results for the experimental trials, that would be analysed, were not displayed on the screen, so that both the experimenter and the subject were blind as to the subject's objective performance. It would be most unlikely, therefore, that the experimenter could unintentionally cue the participant to react in a way consistent with the experimental hypotheses. At the end of the stimulus presentations, the subject's identity code, and the session number, date, and time, as well as the time delay preceding each slide and the subject's response to each slide, were automatically written to disc. Therefore even at the conclusion of the defensiveness testing session neither the participant nor the experimenter could accidentally see any of the participant's results.

5. Development of Stimuli

Traditionally, verbal stimuli such as taboo and neutral words have been used as stimuli in studies of perceptual defence/vigilance (perhaps because of the relative ease of identifying word frequency, of selecting physically similar words such as cancer and canter, and of producing physically similar controls such as nonsense words or inverted/reversed words). Pictorial stimuli have been used less frequently. However, since it is intended to attempt to maximise the similarity of the subliminal and the extrasensory testing situations for this thesis, and since words are rarely used as stimuli in ESP experiments (meta-analyses and 'lab lore' suggest that rich ESP stimuli are associated with higher ESP scoring than are relatively boring or impoverished ESP targets: e.g. Delanoy, 1989; Watt, 1989; Honorton et al., 1990), it was decided to develop pictorial stimuli for use with the perceptual defence/vigilance apparatus as well as for the ESP testing sessions.

It was therefore assumed that, so far as the ESP session was concerned, pictorial stimuli would provide richer target material than verbal stimuli. This assumption was based on the fact that verbal stimuli are relatively familiar to participants and are relatively finite in their numbers (keeping to one language). In contrast, pictorial stimuli may vary infinitely, and while some pictures, like the *Mona Lisa*, are familiar to most participants, it is easy to construct original pictorial stimuli that are likely to be more stimulating to participants than well-learned words. Also, words are limited in their complexity, while pictorial stimuli may vary widely in complexity or the amount of information conveyed. While it can be argued that simple words may evoke complex associations, the same can be said of pictures.

As a first step in developing stimuli for experimental purposes, 58 simple black and white line drawings were produced. Art books and magazines were often used as sources, with pictures there being adapted (by me) for use in the present study. It would of course have been most suitable if one could have located a set of emotional and neutral pictures that had been developed by other researchers, but only one such source was found. I will describe it briefly because it suggests how perceptual defence and vigilance may operate in practical, 'real-life' settings and is therefore of interest in itself.

This was a study by Toch and Schulte (1961) on *Readiness to Perceive Violence as a Result of Police Training*. Advanced police trainees, novice trainees, and psychology students were presented with a series of 18 pictures (simple black and white drawings) at exposures of 0.5 sec, though a stereoscope (so two pictures were presented simultaneously, one to each eye). Half the pictures were 'neutral' and half 'violent' (the authors do not say how the pictures were judged to be neutral or violent; the neutral pictures included 'a farmer' and 'a worker', the violent pictures included 'three murders' and 'two suicides'). For each exposure, a subject was presented simultaneously with one neutral and one violent picture to each eye (and each pair was exposed twice to ensure that each eye was exposed to each of the 18 pictures). Subjects were asked to describe what they saw for each exposure, and most subjects perceived a single picture for each pair that was presented as a stereogram. It was found that, where there were actually 18 presentations of a neutral picture and 18 of a violent picture, the advanced police trainees reported an average of 9.37 violent pictures whereas the novice police trainees and the psychology students reported, respectively, an average of 4.69 and 4.03 violent pictures. Therefore, all subjects *appeared* perceptually defensive to the violent pictures, with the least defensive being the advanced police trainees who reported seeing violent pictures significantly more often than the other two groups of subjects. However, an exposure time of 0.5 seconds is hardly subliminal, and as subjects were asked to describe what they saw, one could interpret these findings not in terms of *perceptual* defence (that is, a decreased readiness to *perceive* violence) but rather in terms of response set or bias (that is, a decreased readiness to *report* violence). Further experimentation would be necessary to clarify this point.

For the purposes of the present study, however, Toch was traced and asked if he could provide his stimulus pictures. Unfortunately he could only locate 12 pictures, 6 violent and 6 neutral, but these were adapted (the original pictures were solid-coloured in black, the adapted pictures were line drawings that were not filled in with colour) and included in the pool of 58 simple line drawings to be rated for emotionality. Twenty individuals (friends and colleagues) were asked to rate each picture as to 'the quality and strength of emotion you associate with each picture'. The rating scale points ranged from 1 ('very strong pleasant emotion') through 4 ('no emotion') to 7 ('very strong unpleasant emotion').

The mean rating and variance scores were calculated for each picture, and these scores were then used to select (for initial experiments) 8 pictures that were widely agreed to be fairly strongly unpleasant in emotional tone (mean emotionality rating, 5.981, range from 5.74 to 6.25; mean standard deviation 0.909, range from 0.79 to 1.07), and 8 pictures that were widely agreed to be neutral in emotional tone (mean rating 3.813, range from 3.55 to 4.15; mean standard deviation 0.58, range from 0.49 to 0.69). It is interesting to note that the negative emotional pictures generally elicited more variation in their rating scores than the neutral pictures. The picture with the highest variance (1.47, mean emotionality rating 3.2, i.e. mildly pleasant) depicted an erotic scene which apparently elicited quite conflicting responses from raters. (Of the 16 selected neutral and emotional pictures, 5 of the neutral pictures and 4 of the emotional pictures were adapted from Toch & Schulte's (1961) stimuli.) Examples of the stimuli used in experiment 7 of this thesis are shown in appendix 6.

So, stimuli were selected according to the responses of 20 raters. Of course, each participant in the subsequent experiments would have their own idiosyncratic emotional responses to each stimulus, and not all would agree with the prior emotionality ratings. Perhaps it would be more effective to produce a 'customised' selection of slides for each subject, where in a preliminary session stimuli were chosen to reflect that individual's personal emotional reactions. The drawback here is that participants would then be cued, prior to the actual experimental sessions, as to the nature of the stimuli and therefore, perhaps, to the nature of the experimental hypotheses. As a compromise, then, it was decided to use 'averaged' stimuli throughout; some of the experiments to be reported later did ask participants to rate their particular emotional responses to the stimuli, thus it was still possible to examine reactions to slides which got especially high ratings.

Each of the neutral and emotional slides had its own 'control' slide. The control was constructed by cutting up and rearranging the line drawing so that the control covered approximately the same area as the meaningful drawing, would transmit the same amount of light as the meaningful drawing, but would have no meaning for the subject; that is, the control line drawing was not intended to convey any recognisable information. It was felt necessary to construct control slides so that if during experiments subjects responded differently, say, to the emotional compared to the neutral drawings, one would be able to evaluate whether this was due to simple physical differences between the two classes of stimuli (e.g. all emotional slides happened to be darker than neutral slides) or whether it was more likely due to the meaning or emotional tone of the slides. Appendix 6 gives examples of stimulus and control slides used in experiment 7 of this thesis.

Having selected the emotional and neutral stimuli, and having created matched control stimuli from them, these line drawings were photographed using Kodak Ektachrome Tungsten 160 film, at an exposure of 1/15 seconds, aperture f 8 3/4, standard E6 processing (these film and exposure details were chosen from preliminary investigations). The stimuli were then made into transparencies and mounted to view.

Conclusion

This chapter described the basic features of the apparatus developed as a potential indicator of perceptual defence/vigilance. Seven experiments were conducted using this apparatus, with slight modifications of stimuli and the computer program that will be described when appropriate. An account of these experiments follows.

Chapter 5. Three preliminary experiments.

Initial exploratory work, involving the development and selection of stimuli for the measurement of perceptual defence using the 'Pandora's Box' apparatus, and the design of basic details of the computer program and the testing procedure, produced a simple procedure that was then examined more formally in three preliminary studies. These studies were principally intended further to refine details of the apparatus and procedure for measuring perceptual defence/vigilance, since this is essentially a prototype methodology. There was, therefore, no attempt at this stage systematically to compare psi performance with perceptual defence/vigilance. However, as free-response ESP scores were available for the participants in experiment 2, and as psychokinesis scores were available for the participants in experiment 3, it was possible to conduct exploratory correlations of psi performance with perceptual defence and vigilance. This chapter reports on these three studies and what was learned from them; details of apparatus and procedure which have already been set out in chapter 4 will not be repeated here, but other procedural details will be covered in greater detail, especially for experiment 1 as this sets a basic pattern for all subsequent studies.

Experiment 1: Subjective brightness judgements of subliminally-presented stimuli.

The aim of this study was to examine whether Pandora's Box showed some promise as an indicator of perceptual defensiveness or perceptual vigilance to subliminally-presented emotional slides; secondary aims were to spot and remedy 'teething problems', to refine interactions with participants, and to identify possible sources of noise in the data. Because this was an exploratory study, there were no formal hypotheses; and because the apparatus was a prototype, it was not possible to specify precisely how one would judge that the apparatus 'showed promise' as an indicator of perceptual defensiveness or vigilance. One might infer from the apparent focus in the literature on *lowering* of perceptual thresholds that perceptual defence is more commonly seen than perceptual vigilance. Little is known about the 'baseline' occurrence of defensiveness and vigilance in the general population, however, so one cannot certainly predict that, for instance, the emotional slides would, over all participants in the present thesis, be associated with the highest brightness scores (indicating perceptual defensiveness). If, as Brown (1961) suggests, defensiveness and vigilance may be associated with personality characteristics such as extraversion and introversion (and, in turn, with people's 'baseline' levels of arousal), then it would be quite difficult to predict, from any relatively small sample of individuals (without taking personality measures) the 'defensive/vigilant/neither' ratio to be found in that sample. If some individuals are 'defensive', some 'vigilant', and some 'neither', then average brightness scores would 'wash out' any effects of defensiveness or vigilance. However, one might expect to find greater *variation* in scoring for emotional compared to neutral or control slides, since perceptual defence and vigilance would manifest, respectively, in relatively high and relatively low brightness scores compared to the other stimulus categories. Also, if the data reveal a real effect of defensiveness or vigilance, rather than simple random variation in responses, then one might expect to see some consistency in scoring, say from the first half of the session to the second half. If there are no signs of distinctive responding to the emotional slides compared to the others, this might indicate that the methodology is unsuitable as a measure of perceptual defence or vigilance (for instance, the slides might not be sufficiently emotional to elicit defensive or vigilant responses, or the slides might be too faint in intensity even for *subliminal* perception); on the other hand, if there were no signs of perceptual defence or vigilance this might suggest that the participants in the study are not particularly defensive or vigilant. No firm prediction is made, though, because this is the first time such a methodology has been tried.

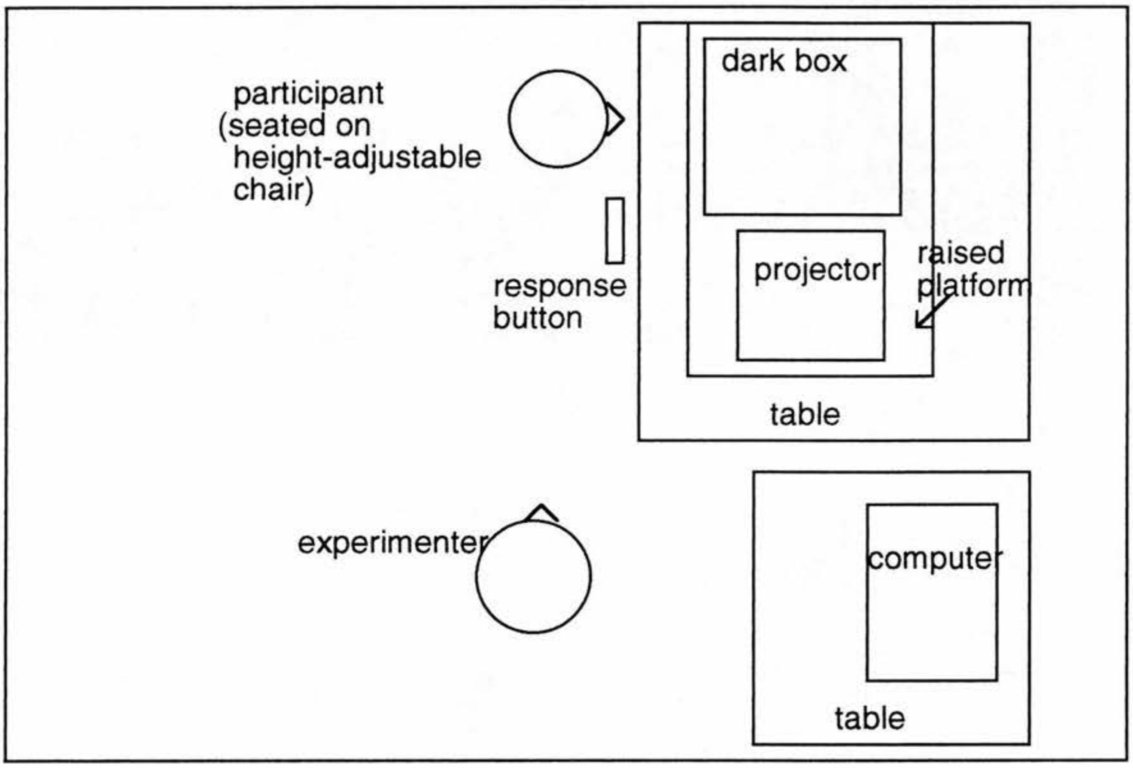
Method

Participants. Twenty-one individuals (15 males and 6 females) took part in this study (this was simply the number of people who were able to participate during the period that the study was running); 16 were my friends or colleagues, 5 (who were previously unknown to me) had taken part in an earlier study conducted by a colleague of mine, and had indicated a willingness to participate in further studies. I conducted the testing sessions.

Stimuli. The stimuli were 32 slides described in detail in chapter 4: 16 portrayed meaningful pictorial information [8 were of negative emotional tone ('E'), 8 were of neutral emotional tone ('N')]; 16 were matched 'control' slides that were meaningless re-arranged versions of the 16 meaningful slides [8 emotional control slides ('EC') and 8 neutral control slides ('NC')]. See appendix 6 for examples of the different stimulus categories, as used in experiment 7.

Apparatus. The 32 stimuli were presented within a modified two-field tachistoscope, described in detail in chapter 4, via a Kodak carousel projector. A BBC computer controlled stimulus presentation and lighting, and recorded results automatically. Participants made their responses by pressing a simple

Figure 5.1
The layout of the experimental room, apparatus, and position of participants



hand-held button that linked with the computer. Figure 5.1 depicts the layout of the experimental room, the apparatus, and the positions of the experimenter and participant.

The participant was seated at a height adjustable chair, facing 'Pandora's Box'. The projector and the dark box were placed upon a raised platform that presented the viewing port of the dark box at a comfortable height for the participant. Concealed below this platform were the potentiometer and the drive unit for the electroluminescent panels (both of which did not need to be touched during experiments). The platform (constructed of chipboard) and table were covered with black fabric, so that as participants looked into the dark box, they were not distracted by light reflecting up from the table and platform. Adjacent to the table holding Pandora's Box was another, smaller table, on which the BBC computer sat. The screen of this computer was angled away from the participants, though they could see it if they desired. The screen simply displayed the results of the practice trials, and monitored the progress of the session with messages such as 'End of first run, press response button when ready to commence second run'. The experimenter sat beside the participant, so the experimenter could see both the participant and the computer screen. The participant could hold the response button in either hand, though most chose the right hand.

Procedure. Each participant completed two sessions on Pandora's Box, roughly one week apart. Each session consisted of two runs of 16 slides (i.e., a total of 32 slide exposures per session), preceded by one demonstration slide and five practice slides. At the first session, half of the subjects responded to half of the experimental slides together with their matched controls, and the second half of the slides at the second session. This was reversed for the other half of the subjects. Therefore, each of the 32 stimuli was shown twice. The order of slide presentation within each run was randomly determined for each subject individually, using the BBC computer's pseudorandom algorithm: prior to the start of the study, I used the algorithm to prepare a number of 'slide sequences'; each sequence was recorded on a slip of paper and put in a manila envelope; when needed, a slip could be removed at random from the envelope.

Prior to the participant's arrival, the experimenter loaded the slide sequence for that participant into the slide tray, and covered the tray with a black cardboard box in order to conceal the stimuli from the experimenter and the participant. The experimenter was not blind to the slide order (since I had loaded the slides into the carousel tray), but it was thought to be extremely unlikely that I would recall the numbered sequence, recall which slide contents went with which number, and somehow communicate biasing information to the participant during the experimental runs, (when I was silent, and when both I and the participant were blind to the participant's objective performance).

When participants arrived in the laboratory, they were offered light refreshments. Participant and experimenter then proceeded to the dimly-lit experimental room. Although it was not necessary for participants to be totally dark-adapted for this study, it was felt that they should all experience similar lighting conditions prior to commencing the experimental runs. It was thought that this would help to ensure that participants who had experienced different lighting conditions prior to arriving at the lab (say, a sunny day for one, a dark night for another) would be more comparable to each other and, more importantly since this was a within-subjects design, to themselves on each of their two sessions. In order to maximise the similarity between the lighting conditions experienced in separate sessions, the lights in the experimental room would be gradually dimmed to just above their minimum level during the 15 to 20 minutes of introductory chat and instructions. Then, just before the participant began to respond to the stimuli in Pandora's Box, the room lights were dimmed to their minimum possible level (approximately 0.7 lux ca., as measured on a Gossen 'Lunasix 3' light meter).

In the experimental room, the procedure was explained and the participant's questions, if any, were answered. It was not felt to be necessary or desirable to deceive participants as to the nature of the experiment, so they were told that it was a study of subliminal perception but that the apparatus was experimental so that there were no firm expectations for specific results. Participants were also told that there was information of some sort on each slide, but that the slides would be presented at such a weak intensity that they would be unable to gain any impression of the slide contents. If participants asked directly what sort of information was on the slides, they were told that the slides were judged either to be emotional or neutral in nature. They were not told whether the slides contained pictures or words, or what effect the nature of the slide might have on their performance, but were promised further details once both sessions had been completed. In fact, few participants asked about the slide nature, and, although no formal analysis was made of this, my impression was that this knowledge did not significantly influence their performance.

Participants were asked to press the response button when they felt they could see the smaller rectangle (that is, the stimulus slide) appearing (brightening) in the centre of the background field. They were told that there was a continuum of possible responses, from the first impression of something appearing (at which stage it was difficult to distinguish internally-generated from external images and so there was a risk of false alarms) to an absolutely certain response to a bright and clear rectangle. As I was interested in the 'marginal' area when the rectangle was just appearing, participants were encouraged to respond when they were certain that what they were seeing was objectively 'out there', though it need not be a fully-formed, clear rectangle. Once they had chosen a particular response criterion, participants were asked to attempt to hold that subjectively constant throughout the experiment. It was stressed that this was not a test of speed, so participants were not to feel in a hurry to respond.

Participants were also informed of the random time delay before each slide brightened (for this experiment, the delay ranged from 1 to 10 seconds), so that they would not become anxious after long delays and they would not waste time and energy trying various strategies for seeing what was not yet there to be seen. The principal reason for this time delay, however, was to circumvent problems of expecting to see something that appeared at regular intervals - participants could begin to anticipate the appearance of a regular stimulus and respond more according to their sense of timing than to their visual perceptions; and this reason was explained to participants. Participants were also informed that there was a maximum brightness limit so the slides could not accidentally get to full brightness, but they were not informed that the brightness limit was set according to their responses in the practice trials (specifically, to the final practice slide). Having observed the brightness scores of a variety of participants in preliminary sessions with the apparatus, I had a good idea of the typical range of responding (as was described in more detail in chapter 4), and could easily spot unusual responses. In practice, there was only one occasion where, on the final practice slide, the brightness level was unusually high (due to the response button malfunctioning). On this occasion the session was re-started, and a standard limit was set at the second attempt.

The order of events once the procedure had been explained to the participant was as follows:

1. Adjust the participant's chair to a comfortable height for viewing inside the apparatus.

2. Dim room lights to minimum level.

3. Enter participant code, date, time and session number into computer.

4. Give the participants the response button, make them comfortable, and ask them to press the button for the first (demonstration) slide. This (blank) slide was gradually brightened to full illumination in order to demonstrate to the participant the shape and position of the rectangle which they would be looking for at lower illuminations in subsequent trials. At this stage, participants who occasionally wore glasses decided whether or not they might need to wear them for subsequent trials (depending on whether they were short- or long-sighted, and on how clearly they could focus on the demonstration slide without spectacles).

5. The participant pressed the button for the first of five practice trials. This slide gradually illuminated and the participant was required to press the button when they became aware of the slide's presence (at which point the slide faded away, and a brightness score was shown on the experimenter's VDU), and then to press again to initiate the next practice slide (the practice slides all contained a simple black and white line drawing of a rectangle, though participants did not report seeing this when they were asked at the end of the session whether they had seen anything on any of the slides). During the practice trials, participants were encouraged to ask questions, and the experimental trials did not proceed until participants were completely clear about what they had to do.

6. After the practice trials, the participant pressed the button to initiate the first experimental run of 16 slides. For these, the participant was required, as before, to press the button when they became aware of the presence of each

slide. Once a slide had been responded to, the computer automatically presented the next slide.

7. When the first run of 16 slides was completed, there was a short break (usually ranging from 30 seconds to 4-5 minutes) so that the participant could rest a little until, when they were ready, they pressed the button to initiate the second run of 16 slides.

8. On completion of the second run, the participant was thanked, and an appointment was set for the second session, about 1 week later.

The experimenter was present throughout the session. The introduction to the experiment usually took 10-15 minutes and the slide presentation usually took another 10-15 minutes. At the second session, participants were given a brief reminder of the procedure, and at the end of the second session the rationale of the experiment was described in more detail, if requested.

Treatment of the data. There were two measures taken during this experiment. The principal one was the brightness level at which each participant chose to respond to each slide. For this, the average brightness level was calculated for each of the four categories of stimuli (E, EC, N, & NC), for each participant. These scores were then ranked. If E slides ranked 1 (that is, on average they got brighter than other slides before the participant responded to them), this was defined as perceptual defence. If E slides ranked 4 (that is, on average they were responded to at lower levels of illumination than the other categories of stimuli), this was defined as perceptual vigilance. If responses to the slides were due more to the physical brightness of the slides than to their meaning, then it was expected that the ranked scores for EC slides would tend to 'shadow' those for the E slides; otherwise, the ranks for EC slides would be expected to vary unsystematically. The second measure was the record of the random time delay prior to the illumination of each stimulus (ranging from 1 to 10 seconds). The average brightness score was calculated for each of the 10 possible time delays, to see whether brightness scores were influenced by the length of the random time delays.

Results of experiment 1

The aim was to get a general descriptive picture of any overall trends or patterns in the data, and to try to identify possible sources of noise.

Consistency of scoring across sessions

1. General scoring trends. It was not felt to be appropriate to calculate test-retest reliability scores, because of the relatively small number of participants and stimuli exposures, and because different stimuli were presented at each testing session. While there was a lot of individual variation in participants' scoring from the first to the second testing session, there was a slight overall trend for participants' brightness scores to decrease (by only .803 brightness steps, on average) from the first testing session to the second. That is, participants were pressing the response button slightly earlier, when the slide was slightly dimmer, on their second testing session. Also, there was a slight tendency for the amount of variation in the second testing session to be lower than in the first (by .115 *SD* units, on average).

2. Consistency of scoring for emotional stimuli. It will be recalled that one measure of interest was the consistency of a subject's scoring from the first to the second session, particularly for the emotional stimuli. If subjects' responses were largely unrelated to the slide nature, then one would expect to find no consistency in scoring across sessions; if the apparatus was measuring perceptual defence or vigilance, one would expect (assuming that perceptually defensive or vigilant responses to emotive stimuli are relatively stable over time) to find consistency in responses to the emotive stimuli across sessions. It is encouraging to note that 7 out of the 8 participants who showed consistent reactions to the emotional slides across the two testing sessions (that is, whose average brightness scores for these slides held the same ranked position for both testing sessions) ranked these slides either 1 or 4 (that is, they appeared to be either perceptually defensive or vigilant as defined in this study).

General scoring trends

As there appeared to be no gross changes in scoring between the two sessions, the data from both sessions was collapsed to form a single data set of 64 exposures (2 times 32 stimuli), and the following descriptive statistics are based on this data.

Table 5.1 shows the overall mean brightness scores, and their standard deviation, for the four categories of stimuli (emotional=E, emotional control=EC, neutral=N, neutral control=NC).

Table 5.1
Mean and standard deviation of brightness scores

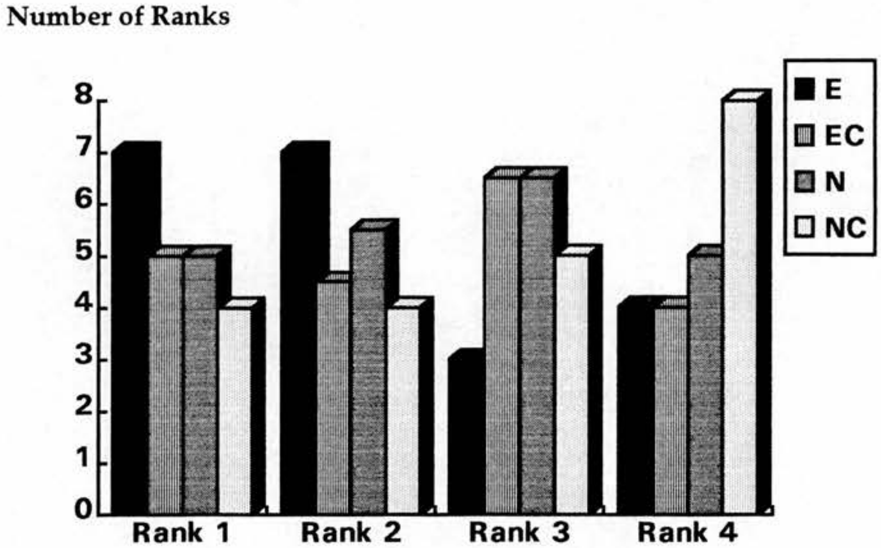
	E	EC	N	NC
Mean	21.470	21.358	21.423	21.405
SD	3.302	3.241	3.346	3.219

E=emotional stimuli; EC=emotional control; N=neutral; NC=neutral control

It can be seen from table 5.1 that the differences in scoring between the four categories of stimuli are quite small, but that the highest overall scores were found for the emotional slides and the lowest for the emotional control slides. This trend may be indicative of overall perceptual defence to the emotive slides, in accordance to what is often found with other measures of defensiveness. Also, the fact that the brightness scores for the emotional control slides are *least* close to the scores for the emotional slides, compared to the neutral and neutral control slides, suggests that these scores are unlikely to be accounted for by the common optical properties of E and EC slides (that each EC slide transmits the same amount of light as its matched E slide, and that the area covered by the stimulus information on each EC slide closely approximates that for its matched E slide). Table 5.1 also shows that standard deviation scores for the meaningful (E and N) slides were slightly higher than for the meaningless (EC and NC) slides.

These descriptive data are portrayed in another form in figure 5.2, which graphs the frequency distribution of ranks for the four categories of stimuli.

Figure 5.2
Bar chart showing frequency distribution of ranked brightness scores in experiment 1, for the four stimulus categories



Thus, as can be seen from figure 5.2, the emotional slides tended to be ranked 1 or 2 more often than the other slides, perhaps indicating an overall tendency towards perceptual defensiveness.

Effects of the random time delay

Another question of interest in this study related to the discovery of sources of noise in the data. One possible source of noise (that is, extraneous variance) could be the random time delay (from 1 to 10 seconds) before each slide began to be illuminated. Perhaps participants would respond differently to the slide after a short delay compared to a long delay. For this reason, the mean and *SD* of the brightness scores for each of the possible time delays was calculated, and the results are shown in table 5.2.

Table 5.2

Mean and standard deviation of brightness scores over time delays from 1 to 10 seconds

Time Delay	Mean Brightness	*SD*
1 sec	22.109	2.190
2 sec	21.757	2.265
3 sec	21.632	2.405
4 sec	21.389	2.565
5 sec	20.854	2.533
6 sec	21.345	2.387
7 sec	20.327	2.300
8 sec	20.634	2.499
9 sec	20.372	2.551
10 sec	20.922	2.926

Table 5.2 shows a trend for shorter delays to be associated with higher brightness scores, and that the amount of variation in scoring tends to decrease with shorter time delays. Variance is greatest at the longest delay. Both of these trends are statistically significant, with the Spearman correlation between brightness and time delay giving r_S=.818 (p<.01, 2-t), and the correlation between *SD* and time delay giving r_S=-.648 (p<.05, 2-t). Perhaps, with the shortest time delays, the participant is 'caught by surprise' by the brightening of the slide, so the slide can get brighter before the participant responds. On the longer time delays, participants may begin to anticipate the appearance of the slide, and with this higher expectancy they may respond to the slide at lower levels of intensity.

Another possible source of noise in the scoring may arise from the fact that each slide was only shown twice. If a trial result had to be rejected for any reason (see the discussion of technical problems, below) that meant there was only one remaining response for that particular slide. A possible improvement to this situation is suggested in the discussion section below.

Technical problems

On the whole, the study ran very smoothly from a technical point of view. Occasionally the response button failed to register a participant's press; here, the slide would brighten to its limit and would not be included in the later analysis. Another problem was that the background field which was usually constantly illuminated would, perhaps once in every 20 sessions, flicker erratically. This problem recurred occasionally throughout the series of experiments reported in this thesis, and technical investigations found no solution. Thankfully this problem was sufficiently rare to enable the discarding of affected trials without impinging greatly on the data set.

Another problem, that applies to this and to the following experiments, is how to decide when to reject an individual brightness score as being an outlier - that is, unusually low or high compared to the participant's standard range of responses. Evidently, if one is expecting there to be particularly high or low scoring for the emotional slides, one wants to avoid the danger of discarding possibly meaningful extreme scores. The approach that was adopted was to inspect the raw data before the slide sequence was known. Brightness scores that had hit the upper limit were automatically eliminated from analysis. Also, scores which were, based on experience of the typical range of responding, ridiculously low (less than 10) were eliminated as likely 'false alarms'. This still left the occasional outlier, that could be seen in relatively high standard deviation scores. In such cases, the outliers would be removed one by one until the *SD* scores reached 'normal' levels. This may seem like massaging the data, but as removal of outliers took place before the slide sequence was known, there is no risk that data are being selectively retained or discarded so as to support or disconfirm hypotheses.

Discussion of experiment 1

This experiment succeeded in its aims of identifying teething problems and possible sources of extraneous variance in the data. There were also some indications that some participants were reacting idiosyncratically to the emotional slides, perhaps suggesting signs of perceptual defensiveness or vigilance to these slides compared to the other slide categories. This latter effect was not strong, however this study gives several pointers towards perhaps strengthening the perceptual defence/vigilance effect by reducing the sources of noise in the data and strengthening the stimulus information both physically and psychologically.

A future study might benefit from reducing the number of stimulus slides, but increasing the number of times each is shown, as this would be expected to lessen possible sources of noise in the data. On the assumption that stronger perceptual defence and vigilance might be seen in response to stronger emotional slides, it would be advisable to remove these emotional slides with the least extreme emotionality ratings, as well as removing their matched control slides and a comparable number of N and NC slides. Thus, if one halved the number of slides and doubled the number of stimulus presentations, so that 16 slides are presented 4 times each, this keeps the session length to the same level as for the present study (that, on informal discussion with participants, seemed to be a comfortable length).

This experiment also demonstrated that the length of the random time delay prior to slide illumination constituted a possible source of variation in scoring, with both mean brightness scores and *SD* scores correlating significantly with the length of the time delay. This may be because, after a long time delay, participants can be more sure that they will soon see the rectangle, and so they may tend to lower their response criteria in anticipation, so responding at generally lower brightness levels for all slides. At the shortest time delay, on the other hand, participants may be 'taken by surprise' by the relatively quick appearance of the stimulus, so allowing it to brighten a little beyond their usual criterion before responding. In a future study it would seem appropriate to cut the extremes of the range of possible time delays, to from 2 to 7 seconds. Thus there is still some variability in the time before stimulus appearance, but not to the extent that participants are caught unawares, or are keenly anticipating the stimulus.

Another way of possibly strengthening the stimulus intensity, while still keeping it well within the 'safe' limits so that participants remain unaware of stimulus nature, is to encourage the adoption of a less conservative response criterion. In the present experiment, participants were asked to respond when they were sure that what they saw was not an internally-generated impression; for many participants this was reported subjectively as being just a blob of light. This criterion could be relaxed a little by asking participants to respond when they could clearly see a rectangle of light; this ought to allow the slide to brighten further, while still keeping the slide contents outside of awareness. It should be noted that in the present study no participants reported any awareness of the contents or nature of the stimuli; indeed they usually expressed surprise when they were shown the stimuli at the conclusion of both testing sessions. Pilot work with this apparatus suggests that when participants are instructed to let the stimuli brighten until they can begin to see (but not recognise) some contents, the average brightness score is around 50 (compared to around 20 in this study). Thus there appears to be room for relaxing the response criterion without risking revealing the stimulus contents.

Also, one might boost the stimulus strength by speeding up the rate at which the slide brightens. The present study had a one tenth of a second delay between each of the 99 possible increments of brightness. This led to the rectangle brightening fairly slowly, and my impression is that this gives participants longer to consider and respond to the slide while it is still relatively dimly illuminated. (This intuition is supported by evidence from the present study that the lower illumination levels were seen after the longer delays prior to illumination). A future study might therefore decrease the delay between each brightness step, thereby speeding up the brightening process overall. By this measure, one might again be able to encourage participants to let the slide brighten further than at present, perhaps thereby increasing the likelihood that participants are unconsciously processing the semantic content of the slide.

A final consideration for improving stimulus presentation is that of transparency brightness. In the present study the pictorial information was dark grey, on a light grey background; in Gregor's original study, however, the stimulus information was light grey against a dark grey background. Thus for Gregor's study the slides were darker overall, and the stimulus information would have been the lightest part of the slide. Light slides with dark pictorial information were chosen for this study because preliminary experimentation had suggested that these were most easily identified at full illumination levels. A future study should present both sorts of stimuli to see whether or not this is an important factor in demonstrating perceptual defence/vigilance.

Experiment 2: Perceptual defence/vigilance and free-response ESP performance, before and after practice of mental training techniques.

This study ran simultaneously with experiment 1, so it was not possible at this point to incorporate the methodological changes suggested by experiment 1. The study was undertaken principally as part of the overall research interests of the Koestler Chair of Parapsychology, and I planned and conducted the parapsychological side of the study together with Dr Deborah Delanoy and Professor Robert Morris. The study involved training participants in several mental skills and taking a regular measure of their performance on a free-response ESP task.

This was a pilot study, intended to train the experimenters in administering the various mental exercises, to explore the usefulness of these exercises, and to try out different kinds of ESP targets and different ways of gaining information paranormally (that is, using different kinds of mental imagery, focusing of attention, and relaxation exercises as strategies for responding to the target). No analyses were formally stated in advance, but care was taken to ensure that no participants or experimenters could know the identity of the ESP target until participants had recorded their ESP impressions and had judged them against the possible target; thus the ESP measures were considered to be free of artefacts that might artificially inflate ESP scores.

Because of my particular interests in perceptual defence and vigilance, I introduced a session on Pandora's Box prior to commencement of mental training, and a second session on Pandora's Box after the final ESP measurement at the end of the study. This report will be mainly restricted to a brief outline of the mental training aspect of the study, and will focus on the perceptual defence/vigilance results and how these related to ESP performance. It is also interesting to examine whether training intended to increase participants' ability to relax and to notice more about their thoughts and feelings will relate to any changes to apparent perceptual defence or vigilance. Little is known about how individuals' perceptual defence or vigilance might change over time, but as defensiveness is generally regarded as a way of coping with stress by denying or shutting out the stressful information, one might predict that training in relaxation and self-awareness would tend to lessen the use of defence as a coping strategy and to increase the use of vigilance. This study will enable a preliminary look at this question. Also, of course, this study will enable a comparison of perceptual defence/vigilance with *free-response* ESP performance; as was pointed out when discussing the defensiveness-psi correlation in chapter 2, there have been relatively few studies comparing defensiveness with free-response ESP performance, and the findings of those studies comparing Defence Mechanism Test scores with free-response ESP scores have been inconsistent.

Method

Participants. The study began with 9 volunteer participants; for personal reasons two individuals were unable to complete the experiment, and their results are not included in the write-up below. The 7 who completed the study were 5 females and 2 males, mean age 40 years, range 21 to 51 years.

Procedure. The procedure for measuring perceptual defence/vigilance was identical to that for experiment 1, with the exception that around 2 months separated the two testing sessions, compared to only 1 week in experiment 1. Participants attended the lab for a total of 10 weekly sessions. The first two sessions were introductory, and at the second of these I administered the first measure of perceptual defence/vigilance. The Eysenck Personality Inventory, which gives measures of neuroticism and extraversion, was also administered at the introductory sessions. At the following 8 sessions, participants were introduced to a variety of mental training techniques, such as mental and physical relaxation exercises, mental imagery exercises, self-esteem exercises, and concentration (focusing of attention) exercises. Participants were encouraged to practice these exercises at home, sometimes in conjunction with an ESP task. There were weekly measures of free-response ESP in the lab, using dynamic video clips as targets. At the final session, I administered the second part of the test of perceptual defence/vigilance.

Results of experiment 2

Because of the small number of participants in this experiment, results are likely to be unreliable in themselves. When taken in conjunction with experiment 1, however, they may help to confirm or throw into doubt the trends seen in that study.

Table 5.3 shows the overall mean brightness and *SD* scores for all participants for each category of slides, together with a breakdown of the scoring for the first and second testing sessions, that took place before and after administration of the mental training exercises. From the table it can be seen that, when the two testing sessions were taken together, there were no obvious trends in this data, especially no extreme scoring for E slides. As in experiment 1, however, *SD* scores were higher for the meaningful (E and N) slides than for the meaningless (EC and NC) slides. Also as in experiment 1, there was a tendency for scoring to be slightly higher in the first session than in the second session.

Table 5.3
Mean brightness and standard deviation scores for each slide category, for sessions 1 and 2, and overall (sessions 1 and 2 combined).

	E	EC	N	NC
Session 1 (pre-training)				
Mean	23.446	23.357	22.982	23.464
SD	2.048	1.881	1.803	1.600
Session 2 (post-training)				
Mean	22.143	22.497	21.847	22.554
SD	2.198	1.925	2.285	2.028
Overall				
Mean	22.764	22.857	22.400	22.998
SD	2.591	2.156	2.459	2.276

Considering how responses to E slides (the indicator of perceptual defence or vigilance) altered after administration of the mental training exercises, it can be seen that in Session 1, E slides were ranked 2 overall, perhaps indicating a tendency towards defensiveness; in Session 2, E slides were ranked 3 overall, perhaps indicating a change towards vigilance. Looking at this trend more closely, we see that 4 out of the 7 participants showed a change towards vigilance from the pre-training to the post-training defensiveness testing session; 2 participants showed no change in responses to E slides, and 1 participant appeared to become more defensive in the post-training session. While this slight trend is what one might expect after training to encourage relaxation and an openness to internal impressions, it would be premature to take it seriously as an indication of changes in defensiveness after training. This would, however, be an interesting point to examine more systematically in a future study.

For comparison with experiment 1, figure 5.3 depicts the overall frequency distribution of ranks for the four categories of stimuli. Unlike what was found in experiment 1, there is no suggestion of extreme scoring for E slides; instead, there is a tendency for the control slides (EC and NC) to be ranked 1 more often than the other slides.

Table 5.4 shows the overall mean brightness and standard deviation in scores for all slides for each length of time delay prior to slide brightening.

Figure 5.3
Bar chart showing frequency distribution of ranked brightness scores to the four categories of stimulus slides

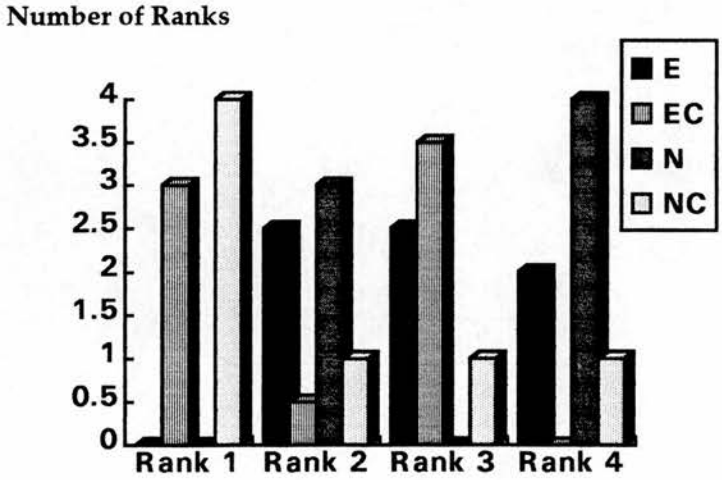


Table 5.4
Mean brightness and standard deviation scores over time delays from 1 to 10 seconds

Time delay	Mean Brightness	*SD*
1 sec	23.436	1.527
2 sec	22.689	2.448
3 sec	23.016	2.085
4 sec	22.146	2.170
5 sec	22.146	2.170
6 sec	22.713	2.224
7 sec	22.717	2.173
8 sec	22.857	2.617
9 sec	22.188	2.351
10 sec	22.838	2.625

Again with caution due to the small number of participants in this study, table 5.4 appears to confirm the trend found in experiment 1, for shorter time delays to be associated with higher brightness scores and lower variance, while longer time delays are associated with lower brightness scores and higher variance. The correlation between brightness scores and time delay is positive, though, unlike the correlation in experiment 1, not statistically significant (r_S=.136). As was found in experiment 1, the amount of variation in scoring was significantly correlated with time delay (r_S=-.700, p<.05, 2-t) This supports the recommendation from experiment 1 to reduce the range of possible time delays, based on the assumption that extremely short and long time delays introduce a source of extraneous variance into the data.

ESP results. The ESP task was for the participant to gain impressions of a brief video clip (the 'target') that was being shown in another, sensorially isolated, room. At the conclusion of the experiment, two independent experienced judges, who were blind to the actual target identity, rated the participants' mentations for their degree of correspondence with a pool of four video clips for each ESP session, one of which was the target. Thus, there was a 25% likelihood of selecting the correct target by chance alone. The video clips in a target pool were then ranked such that the film that had the closest correspondence with the participant's mentation was ranked 1, and the clip that was least like the mentation was ranked 4. Mean chance expectation for target ranks was therefore 2.5.

The 7 participants each completed 8 formal ESP sessions, giving a total of 56 trials, with a mean target ranking of 2.6. Thus, ESP scoring overall was slightly negative, but not significantly so (sum of ranks Z=-0.597). Four out of 7 participants showed an improvement in ESP performance over time, but since 3 of these participants' scores were below MCE in the first half of the study, the improvements in their scores could simply be regression to the mean of 2.5. Therefore, there was no significant ESP performance overall, and no evidence of any improvement in ESP scoring with training.

Defensiveness-psi relationship. Experiment 2 provided the first opportunity to correlate performance on the prototype measure of perceptual defence/vigilance with psi performance. As the independent judging of participants' mentations on the ESP task did not take place until after the conclusion of the entire study, I could not have had any knowledge of the ESP scores that the judges allocated to each participant at the time of the defensiveness testing, and so one cannot argue that I could have somehow biased participants' responses on the post-training defensiveness testing session in accordance with my expectations.

There was a nonsignificant correlation (Spearman's *rho*) in the expected direction of -0.514 between participants' overall free-response ESP performance and their responses to the E slides on the measure of perceptual defence/vigilance (summed across both defensiveness testing sessions). That is, those participants whose brightness scores for the E slides were the highest (perhaps indicating perceptual defensiveness) tended to score relatively poorly at ESP, while those participants who appeared to be perceptually vigilant tended to score relatively well at ESP. This finding provides some independent support for the defensiveness-psi relationship described in chapter 2.

The correlation between responses to the EC slides and ESP performance was r_S=0.156, therefore the relationship between ESP performance and performance on the prototype indicator of perceptual defence/vigilance was as one would expect if participants were perceptually defensive or vigilant to the emotional slides: a greater correlation was found for the emotional slides than for the matched emotional control slides.

Looking more closely at the *pre-training* session on Pandora's Box and ESP scores from the first half of the study, there was a significant correlation in the expected direction between ESP and responses to E slides on Pandora's Box (r_S=-.764, p<.05, 1-t), while that for EC slides was -.318. For the *post-training* session, scores on Pandora's Box correlated with the ESP scores from the second half of the study, r_S=-.039 for the E slides, and r_S=.333 for the EC slides. Therefore, the defensiveness-psi relationship in experiment 2 was found only for the *pre-training* measure. This is what one might expect, based on the assumption that practice with mental training exercises that are intended to improve relaxation and self-esteem might reduce an individual's characteristic defensive reactions.

Personality measures. Finally, it will be recalled that participants completed measures of extraversion and neuroticism during their introductory sessions. These scores were correlated, using the Spearman correlation coefficient, with perceptual defence/vigilance scores. For extraversion, r_S=.064 for Emotional slides, and unexpectedly r_S=.817 for emotional control slides (significant at p<.05, 2-t). For neuroticism, r_S=-.145 for emotional slides, so that the more defensive individuals were more neurotic, and r_S=-.154 for emotional control slides. This defensiveness-neuroticism correlation is as one might expect, since, as described in chapter 1, defensiveness/repression has been linked with neuroticism both theoretically and empirically.

Given the small number of participants, these figures must be taken with caution, but it is planned to continue to examine the personality correlates of apparent perceptual defensiveness/vigilance in later experiments. This is an important consideration in the development of the prototype apparatus for measuring perceptual defence and vigilance: if one can identify theoretically-relevant correlations between responses on this pilot apparatus and other well-validated measures of individual differences such as neuroticism, then this will help to validate the pilot apparatus as a measure of defensiveness/vigilance.

Discussion of experiment 2

As with experiment 1, this study suggested that any effects of perceptual defence or vigilance to subliminally-presented emotional stimuli were very weak. Nevertheless, it was encouraging to find correlations in the expected direction (one of which was statistically significant) between responses to E slides on Pandora's Box and free-response ESP performance, whilst there were no consistent or significant correlations for the control stimuli.

It was also encouraging to find that the main defensiveness-psi effect in this study occurred for the *pre-training* measure; this is what one might expect if the mental training exercises had reduced participants' habitual defensive responses to emotional stimuli. This study is the first to permit an examination of the defensiveness-psi correlation using the prototype indicator of perceptual defence/vigilance; given the small number of participants, one can only tentatively suggest that this study appears to support the findings of the DMT-ESP studies reviewed earlier.

Experiment 2 has also been useful in confirming the need for the methodological changes suggested by experiment 1. A fundamental problem of this methodology remains the weak effect, and the apparent susceptibility of the measure to sources of extraneous variance in scoring. The third preliminary experiment attempted to address this problem.

Experiment 3: Perceptual defence/vigilance and psychokinesis (PK) performance.

The aim of this study was to strengthen the weak signs of perceptual defence/vigilance which appeared in experiments 1 and 2. Several methodological changes were made (as detailed below) with this end in mind. Also, as several of the participants in this study had previously acted as subjects in PK experiments conducted by a colleague (Loftur Reimar Gissurarson), it was possible to correlate these individuals' PK and defensiveness scores.

Method

Participants. In an attempt to increase the power of this study, it was decided to set a criterion for inclusion of participants' results in the final analysis. If a participant, in either the first half or the second half of the session, had emotional slides ranked 1 or 4, then their data would be included (thus, it was hoped to include those participants who showed particular signs of perceptual defence or vigilance). It was decided in advance to run sufficient individuals through the procedure so that I would have the data of 24 'criterion' participants to work with. The results below are all based on the results of these criterion participants, with the exception of the data on the effect of the random time delay on slide responses, which is for all participants.

31 individuals took part in this study. Of these, 7 were colleagues who had previously participated in my experiments 1 or 2. The remaining 24 had taken part in computer PK studies conducted between 1 and 3 years previously, who at the time had indicated a willingness to take part in future studies. 29 participants were required to meet the criterion number of 24. Data were collected from all 31 participants, but the data of the final 2 was not scored (because by then the criterion number of participants had been reached). Of the 24 criterion participants, 13 were female and 11 were male.

Stimuli. The stimuli were 16 slides, half of those used in experiments 1 and 2, that were shown 4 times each. Thus, there were a total of 64 stimulus exposures, the same as in experiments 1 and 2. The slides that were discarded were those that some participants had had difficulty identifying at full brightness, or those that had the least extreme emotionality ratings, plus their matched controls. The aim was to strengthen the impact of the emotional slides. Whereas the mean emotionality rating for the E slides used in experiments 1 and 2 was 5.981 (with a maximum rating of 7), that for the slides used in this study was 6.16.

One additional change in the procedure was to use two stimulus conditions, to address the point raised in experiment 1 about the nature of stimuli used in the original study by Gregor. In the LIGHT condition, the slide background was light and the picture was dark, as in experiments 1 and 2; in the DARK condition, the slide background was dark and the picture was light, as Gregor (1972) had done. The latter condition was introduced to see whether any stronger effects would be gained when the stimulus information was actually the brightest part of the slide, rather than the darkest.

Apparatus. The apparatus was identical to that used in experiments 1 and 2, with 2 exceptions. The computer program was modified so that each slide brightened slightly faster than in previous studies (this change was introduced in the expectation that it would allow the slides to get brighter before participants responded to them). Secondly, the random time delay prior to slide brightening was changed from the 1 to 10 seconds used in experiments 1 and 2, to 2 to 7 seconds (this was in order to reduce the apparent influence of extremely short or long delays on participants' responses).

Procedure. Whereas in the first two experiments participants completed two separate sessions on Pandora's Box, at least 1 week apart, in this study these two sessions were collapsed into one (this change was introduced in the expectation that it would reduce intra-individual variation in scoring, since the pariticipant's general mood, alertness, and perhaps also perceptual sensitivity, would be expected to remain relatively stable in a single session). In order to counteract possible fatigue from a slightly longer session, care was taken (as detailed below) to allow participants to rest periodically during the session.

Apart from the changes already detailed, the overall procedure remained very similar to that used in experiments 1 and 2. Half of the participants saw LIGHT slides only, the other half saw DARK slides only. The session was divided half-way by a rest break into two runs of 32 slides each. The length of this break was determined by the participant, as they were encouraged to continue when they felt refreshed, but it usually ran from about 2 to 10 minutes. Each run was also divided half-way by a shorter break. Also, as suggested in the discussion to experiment 1, participants were encouraged to adopt a less stringent response criterion. In experiments 1 and 2, they had been asked to respond when they began to see a brightening area that they were confident was 'out there' rather than being internally-generated visual imagery. For this experiment, participants were asked to let the stimulus slide brighten beyond their first visual impressions, until they felt they could begin to see the rectangular shape of the stimulus slide. The aim of this change was to let the slides brighten further than before, though still ensuring that the participants remained unaware of the stimulus contents, in the hope that this would strengthen participants' possibly defensive or vigilant unconscious reactions to the stimuli.

Because stimulus slides were expected to brighten further in this study, care was taken at the end of the session to ask every participant whether they had at any time seen anything apart from the rectangular slide shape to which they were responding.

Results of experiment 3

Again, as this was regarded as a preliminary experiment, no analyses were pre-planned. The results that were felt to be most informative are reported below.

11 out of 14 participants in the LIGHT slides condition met the criterion requirement (that is, their mean brightness scores to the E slides were ranked either 1 or 4 in either half of the session, possibly indicating signs of

defensiveness or vigilance), and 13 out of 15 participants in the DARK slides condition met the criterion requirement.

Table 5.5 shows the overall mean brightness scores, and their *SD*s, for the DARK slides and the LIGHT slides. For the DARK slides there were no signs of distinctive responding to the E slides compared to the others. For the LIGHT slides, there was some suggestion of overall defensiveness to the E slides, as these had the highest brightness scores of all four categories of stimuli. Unlike experiments 1 and 2, that had found slightly higher *SD* scores for the meaningful (E and N) slides compared to the meaningless control slides, this study found no clear trend for *SD* scores.

Table 5.5
Mean and standard deviation of brightness scores to the four categories of stimuli, for LIGHT and DARK slide conditions

	E	**EC**	**N**	**NC**
DARK Slides				
Mean	50.450	50.716	50.894	49.632
SD	5.653	5.376	5.507	5.871
LIGHT Slides				
Mean	34.602	34.280	33.892	33.890
SD	6.443	6.820	6.841	6.810

Figure 5.4
Bar chart showing the frequency distribution of ranked brightness scores for DARK slides

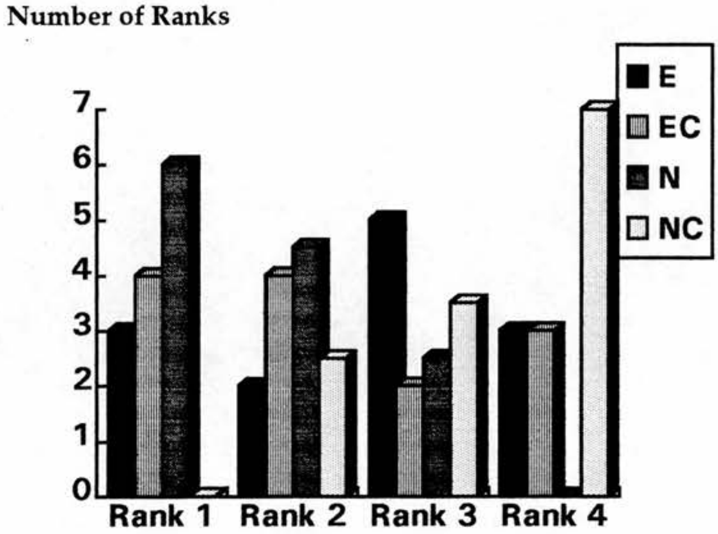
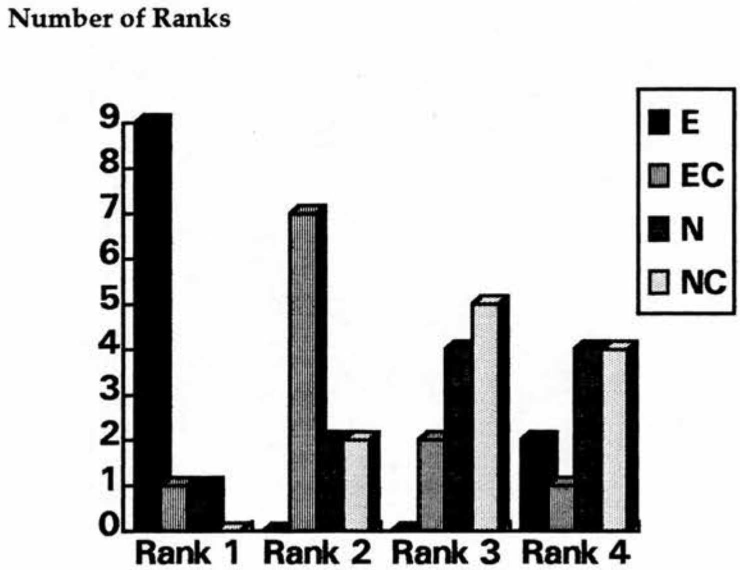


Figure 5.5
Bar chart showing the frequency distribution of ranked brightness scores for LIGHT slides



Figures 5.4 and 5.5 show the frequency distribution of the rankings found for the brightness scores for the DARK and LIGHT slide categories.

As figure 5.4 shows, the ranked brightness scores for E slides in the DARK slide condition were fairly evenly distributed, so apparently there was no overall extreme scoring for the E slides. For the LIGHT slides condition, however, figure 5.5 shows that a high proportion of participants had the highest brightness scores for the E slides. In fact, 9 out of 11 participants in this condition responded most slowly to the emotional stimuli compared to the other stimuli, suggesting overall defensiveness to the emotional stimuli.

Table 5.6 shows mean brightness and *SD* scores for all participants (not just criterion participants), depending on the length of time delay prior to slide brightening, and over light and dark slides separately. It will be recalled that experiments 1 and 2 suggested that extremely short or long time delays might introduce extraneous variance into subjects' responses, therefore for this experiment the range of possible time delay was restricted to from 2 to 7 seconds.

It appears from table 5.6 that the reduced range of time delay has reduced the variability in scoring which had been seen at extreme delays. For the LIGHT slides condition, mean slide brightness correlated r_S=.771 with time delay, which is in the same direction as in experiments 1 and 2, but which is not statistically significant in the present analysis with an n of only 6. *SD* correlated only .086 with time delay in the LIGHT slides condition. For the DARK slides condition, mean slide brightness correlated only .2 with time delay, and *SD* correlated -.029 with time delay. These non-significant

Table 5.6

Mean brightness and standard deviation scores for LIGHT and DARK slide conditions, over time delays from 2 to 7 seconds

	LIGHT Slides		DARK Slides	
Time Delay	**Mean Brightness**	***SD***	**Mean Brightness**	***SD***
2 sec	34.650	2.719	51.032	3.873
3 sec	35.176	2.616	50.430	3.838
4 sec	34.492	2.377	50.793	3.814
5 sec	34.212	2.701	50.794	3.896
6 sec	34.115	2.754	50.895	3.886
7 sec	34.370	2.499	50.465	3.518

correlations confirm, therefore, that by reducing the range of the random time delay from 1-10 seconds to 2-7 seconds, a source of extraneous variance in the data has been reduced.

Perceptual defence/vigilance correlated with PK performance. Although this experiment was not planned with a view to comparing perceptual defence/vigilance to psi scoring, it happened that all participants in this study had at one time or another attempted a computer PK task, 'Synthia', devised by Loftur Reimar Gissurarson. It was decided, therefore, to take the opportunity to look back at Gissurarson's records and correlate PK performance with perceptual defence/vigilance. I was unaware of participants' PK scores at the time the defensiveness sessions were conducted, so it cannot be argued that my knowledge could have biased the outcome of the defensiveness testing (recall also that for experiment 2 the independent judging of participants' free-response ESP mentations took place *after* the defensiveness testing session).

The computer PK task 'Synthia' consisted of a VDU display of four windows, one of which was designated the 'target' window by the computer, and the participant's task was to press the space bar on the keyboard and try to make the computer 'select' that window. When the space bar was pressed a random number was generated to randomly select a window. Thus, the participant's implicit aim was to bias the output of the random number generator so as to select the designated target window. If the target window was selected then a hit was scored. There was a one in four chance of selecting the target window by chance alone. In most versions of Synthia, participants did two runs of 40 trials each, therefore MCE was 20 hits. Spearman correlation coefficients were calculated between PK scores and responses to Light E, Light EC, Dark E, Dark EC, and all E and all EC slides respectively.

As for the data above, only the results of the 24 criterion participants are included in this analysis. While there is a long history of correlating defensiveness with ESP, so that one-tailed probability values may be used, PK has never before been correlated with defensiveness, so two-tailed probability values should be used. The results of the Spearman correlations between PK scores and ranked brightness scores for E and EC slides on Pandora's Box are shown in table 5.7.

It can be seen from table 5.7 that there is a small positive correlation between PK scores and responses to emotional slides, such that individuals who are perceptually defensive tend to score less well at the PK task than individuals who are vigilant. For all participants, this correlation is .291, a value that is not statistically significant on a two-tailed test, given that there are only 24 pairs of observations (one would need a correlation of .407 for $p<.05$, 2-t with

Table 5.7

Spearman correlations of PK scores and brightness scores on Pandora's Box, for the DARK slides and the LIGHT slides conditions, and for both conditions together

	DARK slides (n=13)	
	Rank E	**Rank EC**
PK	.124	-.431
	LIGHT slides (n=11)	
	Rank E	**Rank EC**
PK	.188	.162
	All slides (n=24)	
	Rank E	**Rank EC**
PK	.291	-.183

n=24). As one would expect, there appears to be no consistent correlation between reactions to the emotional control slides and PK scores.

Discussion of experiment 3

This experiment attempted to strengthen signs of perceptual defence/vigilance by: 1. cutting out sources of noise in the data (by halving the number of stimuli and doubling the number of stimulus exposures, by conducting only 1 long testing session rather than 2 short sessions, and by reducing the possible range of the random time delay prior to slide brightening); 2. by boosting the psychological and physical strength of the stimuli (by using stimuli that had higher emotionality ratings than in experiments 1 and 2, and by adopting measures intended to let the stimuli get brighter before participants responded to them); and 3. by exploring whether light or dark slides might give a stronger perceptual defence effect, since the original study by Gregor used dark slides. Fortuitously, it was also possible to correlate scoring on a computer PK task with perceptual defence/vigilance.

Reducing the possible range of the random time delay prior to slide brightening appeared, as planned, to remove a source of noise from the data: correlations between mean brightness and *SD* scores, and time delay, were not statistically significant in the present study with a 2-7 second time delay, whereas they *had* been significant in experiments 1 and 2, with a 1-10 second time delay.

Judging from the overall mean brightness scores, participants were doing as requested and allowing the slides to brighten further than in experiments 1 and 2 before pressing the response button. Taking the brightness scores for the LIGHT slides, for instance, mean scores were around 34 brightness steps for the present study, compared to around 22 brightness steps for experiments 1 and 2. Mean brightness scores were around 50 for the DARK slides in experiment 3 because these slides, transmitting less light than the LIGHT slides, had to be exposed to considerably stronger light before participants could see the small rectangle of light to which they were responding.

When asked whether they could see anything on the purportedly subliminal slides, one participant felt he had some visual impressions that may have corresponded with one of the stimulus slides when he was able to see that slide clearly at the end of the session. However, this particular participant was already familiar with the stimulus materials, methodology, and hypotheses of this study, so he may have had greater expectations of the slide contents than most of the other participants. Four other participants reported having some vague visual impressions, but when they saw the stimuli they considered that their impressions had not been related to the contents of the stimuli. Thus it appears that, on a subjective level, the participants were not consciously aware of the nature of the stimuli (indeed many participants expressed surprise and disbelief when they later learned that there had been images on each slide).

Whereas there was no distinctive pattern of responding to the DARK slide condition, 9 out of 11 participants in the LIGHT slide condition responded most extremely to the emotional stimuli, compared to the other slides. While far from conclusive evidence of perceptual defensiveness and vigilance to emotional compared to other slides, it is interesting to note that there was a higher correlation between perceptual defence/vigilance and PK performance in the light slide condition than in the dark slide condition. This was the first attempt to correlate PK scores with defensiveness, and the overall correlation of .291 is of a moderate size for the behavioural sciences (Cohen, 1977), though with only 24 participants it is not statistically significant. This correlation is, however, congruent with the overall defensiveness-psi relationship that has been suggested by the studies reviewed in chapter 2.

Conclusions

These three preliminary experiments have begun to refine the prototype procedure for measuring perceptual defence/vigilance. It has been seen that any relatively high or low brightness scores on the subliminally presented emotional slides (which are taken to be indications, respectively, of perceptual defence and perceptual vigilance), compared to those for emotional control slides, are extremely weak and certainly not of the magnitude one would have hoped for given Gregor's results. It is possible that the attempted methodological improvements over Gregor's method have 'thrown the baby out with the bathwater'; alternatively, Gregor's results may have been inflated due to the possibilities for artefact which existed with his method.

Nevertheless, despite these weak effects some encouraging correlations were found between psi scoring and perceptual defence/vigilance. There was a nonsignificant correlation in the predicted direction between responses to subliminally presented emotional slides and free-response ESP (r_S=-.514), while that for the emotional control slides was r_S=.156. Also, experiment 2 found a weak correlation in the expected direction between Eysenck's neuroticism and perceptual defence/vigilance (r_S=-.145; more defensive more neurotic). With only 7 participants, the results for experiment 2 must all be considered preliminary. Experiment 3 permitted the correlation, for the first time, between performance on a computer PK task and perceptual defence/vigilance. Again, the results were encouraging, with a moderate sized correlation in the expected direction (more vigilant scored better at PK) of r_S=.291, whilst that for the control slides was r_S=-.183; because there were only 24 criterion participants in experiment 3, this correlation was not statistically significant.

In chapter 2, I argued the need for a conceptual replication of the DMT-ESP studies. While experiments 2 and 3 make a small step in this direction, it is desirable to attempt a more rigorous replication, using an ESP measure that is designed to be quite similar to the subliminal perception measure, thus perhaps increasing the likelihood of any similarities between subliminal and extrasensory perception emerging. This is one aim of experiment 4.

Chapter 6. Experiment 4: Perceptual defence/vigilance and forced choice ESP performance.

This chapter will review the rationale for a comparison of perceptual defensiveness/vigilance and ESP performance, and will outline again the particular methodology developed for this purpose, before reporting on such an experimental comparison.

A variety of measures, described in chapters 2 and 3, have been used to identify individuals as 'defensive'. These measures range from 'paper and pencil' tests where subjects are required to introspect about their reactions in hypothetical situations that may evoke defensiveness, to questionnaires on 'openness', to measures of fluctuations in perceptual thresholds in response to weakly-presented emotive stimuli. I have chosen to study defensiveness as it is defined within this last context of subliminal perception research (e.g. Brown, 1961; Dixon, 1981): individuals are presented, under difficult perceptual circumstances, with emotional and neutral information; those who take longer to report awareness of emotional than neutral stimuli are described as 'perceptually defensive', while others who are 'perceptually vigilant' report awareness of emotional stimuli more quickly than for neutral stimuli. Thus, differential reports of awareness for emotional and neutral stimuli are the indicator of defensiveness/vigilance.

The subliminal perception paradigm was chosen for the studies in this thesis because it shared some similarities with, but had some advantages over, the Defence Mechanism Test. The DMT had been systematically used in a series of studies demonstrating a relationship between defensiveness and psi, but there was a need for independent replication of these 'DMT-ESP' studies. It was argued that difficulties associated with the use of the DMT, including the need for extensive training in test administration and scoring, had discouraged other parapsychologists from attempting to replicate the DMT-ESP studies, and thus from following-up the interesting process-related questions of how and why defensiveness relates to psi performance. The subliminal perception paradigm resembles the DMT in that it uses weakly-presented emotive stimuli that may evoke perceptual defence.

The strength of methods such as the DMT and subliminal perception techniques is that they apparently enable the observation of defensiveness in action (as seen in the distortions of perceptions, or reported perceptions), without any self-consciousness or introspection on the part of the subject. However, compared to the psychoanalytic assumptions underlying the DMT, the definition of 'perceptual defence' and 'perceptual vigilance' as used within subliminal perception studies is quite narrow - relating simply to the apparent fluctuations in perceptual thresholds for emotive compared to neutral stimuli. Consequently, using this latter objective definition, defensiveness can be quite simply measured by a variety of subliminal perception techniques. A number of these were reviewed, their strengths and weaknesses were noted, and a prototype indicator of perceptual defence/vigilance was identified as a potentially useful tool for further exploring the defensiveness-psi relationship. Chapter 5 described three preliminary experiments that showed some promising indications of relationships in the expected direction between performance on this prototype indicator and performance on psi measures (both free-response ESP and PK), and on a personality measure of neuroticism.

It should be noted that this subliminal perception indicator of defensiveness/vigilance may be tapping into something different from the DMT. The latter test is based on the Freudian theory of defence mechanisms and the complex scoring of the DMT is thought to reflect the operation of these defence mechanisms, such as 'repression' (often considered analogous to perceptual defence, e.g. Dixon, 1981; Wagstaff, 1974a). Cooper and Kline (1986) found no correlation between responses on the repression scale of the DMT (that they expected would be most likely to correlate with perceptual defence) and a measure of perceptual defence, a finding that they concluded 'cast(s) doubt on the validity of this scale of the test' (p.19), and that reinforces the possibility that the DMT is measuring something different to measures of perceptual defence (assuming that repression ought, theoretically, to be similar to perceptual defence).

While the DMT is based on assumptions of a motivational basis to test responses, studies of perceptual defence and vigilance have, as we have seen, usually attempted to demonstrate that the differential responding to emotional and neutral stimuli are due to fluctuations in *perceptual sensitivity*, rather than to motivational or response bias effects; for example, early studies into subliminal perception that asked subjects to signal their recognition of taboo or neutral words by saying the words aloud were criticised because it was felt that subjects might hesitate to say taboo words aloud - this hesitation might look like perceptual defence (that is, raised perceptual thresholds), but in fact it could be a response effect. The distinction between physiological and motivational explanations for defensiveness may be more apparent than real - perhaps these are simply two different aspects of a single phenomenon, two different levels of explanation, two different theoretical viewpoints. Whether one is more 'important' than the other is difficult to say, and it is not the aim of this thesis to try to answer that question. Having adopted the paradigm of subliminal perception because of its strengths, I must also adopt the narrow definition of perceptual defence/vigilance, as fluctuations in sensory thresholds, that is associated with this paradigm. It is not, however, necessary at this stage to be able to explain *why* thresholds apparently fluctuate for emotional compared to neutral stimuli. The main question for this thesis concerns the identification of a methodology that enables further exploration of the defensiveness-psi relationship.

Adopting this particular definition of perceptual defence/vigilance enables one to overcome some of the drawbacks associated with the DMT identified earlier:

1. Subliminal perception techniques may be rapidly and automatically administered and objectively scored, thus requiring little specialist knowledge or training;

2. Studies of the defensiveness/psi relationship may allow more detailed examination of situational, methodological and personality variables which perhaps contribute to psi-hitting or psi-missing. For instance, Delanoy (1989) and Watt (1989) have pointed out the need for systematic research into what makes a successful ESP target. There is theoretically no restriction on the nature or quantity of stimulus material which may be used in the subliminal perception task used to identify individuals as perceptually defensive or vigilant. The DMT, on the other hand, usually scores individuals' responses to only two supposedly threatening pictures. One could argue therefore that the former method allows more scope for exploration of the nature of the defensiveness-psi relationship, especially where target variables are

concerned. The detailed scoring scheme of the DMT may, however, provide more insight into what aspects of defensiveness are particularly associated with success at ESP tasks, and this question is to be addressed following completion of the 10th Icelandic DMT-ESP study (Haraldsson, 1991, personal communication). For instance, although the DMT-ESP studies have shown a steady decline in the size of the defensiveness-psi correlation over the years, it may be that one or more of the sub-scales of the DMT - repression for instance - would correlate more strongly with psi performance. Depending on the theoretical assumptions underlying the various Freudian defence mechanisms, one might be able to begin to hypothesise why a particular scale of the DMT correlates relatively strongly with psi performance, and perhaps such a hypothesis might in turn suggest something about the psi process.

3. The DMT-ESP studies typically used a relatively neutral forced choice ESP target such as a choice of four windows on a computer screen, or a sequence made up of four letters of the alphabet. Perhaps the defensiveness-psi correlation would be strengthened by incorporating emotionally negative targets in the ESP measure. The rationale here is that, by maximising the similarity of the defensiveness and the psi testing situations, one might also maximise the chances of observing the defensiveness-psi correlation. This is not a new idea; in fact it was suggested in the first ever DMT-ESP report: 'If the ESP targets were constructed out of threatening figures rather than geometric designs, would the effect be stronger?' (Carpenter, 1965, p.73). The defensiveness-psi correlation might be further increased by using similar, if not identical, stimuli both for the measure of perceptual defence/vigilance and for the ESP task. While this would be difficult using the DMT, the use of a subliminal perception task to identify individuals as perceptually defensive or vigilant permits experimentation with various stimuli.

4. Several parapsychologists have drawn parallels between perceptual defence/vigilance seen in subliminal perception and psi-missing/hitting seen in extrasensory perception (i.e., scoring consistently below or above chance expectation; Beloff, 1974; Irwin, 1979; Roney-Dougal, 1987). For many researchers these parallels are congruent with the assumption that, although the mechanism whereby psi information reaches an organism may be different to the mechanism whereby subliminal information reaches the organism, both do so initially at an unconscious level, and both are consequently subject to similar distortions and transformations prior to emergence in conscious awareness. However, these parallels have not, to my knowledge, been directly studied.

The DMT, though identifying individuals as 'defensive', is a projective psychological test using two emotional stimuli that are initially subliminal but are later visible. This methodology does not allow for the identification of individuals as perceptually defensive or vigilant as defined in the subliminal perception literature. Wiklund (1975) compared 'openness to preconscious processing', as identified by a subliminal perception task where 'open' individuals reported seeing a visual illusion, to ESP performance. *Post hoc*, it was found that 3 individuals who were apparently resistant to subliminal perception psi-missed at the ESP task, but this was not an unambiguous conclusion, and the subliminal perception task was not one that traditionally is used to identify individuals as perceptually defensive or vigilant.

For all of the above reasons, three preliminary studies, reported in chapter 5, were conducted with the aim of developing a prototype methodology for indicating perceptual defensiveness/vigilance. Two of these studies incorporated measures of psi and both showed nonsignificant but suggestive correlations in the predicted direction between apparent perceptual defence/vigilance and psi scoring.

The present experiment aimed to follow up on these findings, using ESP measures specifically designed for maximum similarity to the subliminal perception measure. In addition, two personality measures would be administered. 1. Byrne's (Byrne, 1961; Byrne, Barry, & Nelson, 1963) Repression-Sensitization (R-S) Scale, that claims to identify as 'repressors' individuals who tend to respond to threatening stimuli by avoiding (denying, repressing) them, and as 'sensitizors' those who tend to approach (intellectualize, obsessionalize) threatening stimuli. Though there have been criticisms of the validity (Cooper, 1982) and the application (Chabot, 1973) of the R-S scale, I was curious to see whether the R-S scores correlated with the subliminal perception measure of defensiveness taken in this study, since on the face of it 'repression' appears to resemble perceptual defence and 'sensitization' appears to resemble perceptual vigilance. 2. The Eysenck Personality Inventory (EPI), giving a measure of extraversion and neuroticism, that was also used in experiment 2. It will be recalled that experiment 2 showed a correlation between apparent perceptual defensiveness and neuroticism (but not extraversion); this correlation could be important to the development of a measure purporting to identify individuals as perceptually defensive or vigilant, since both perceptual defence and neuroticism might be regarded as maladaptive responses to stress (Costa & McCrae, 1992). Neuroticism is a well-established personality factor, and if the prototype measure of defensiveness consistently correlates with neuroticism then this may suggest that there is some construct validity to the defensiveness test.

When they originally volunteered to participate in a study with the parapsychology unit, each participant filled out an extensive 'Participant Information Form' (PIF). This confidential questionnaire includes several questions about belief in and experience of psi phenomena. Participants who believe in and/or have experienced what they interpret as psi phenomena are traditionally called 'sheep'; 'goats' are those who disbelieve in psi phenomena and who have not interpreted any of their experiences as psychic. Parapsychologists have found that sheep tend to score consistently positively at psi tasks, while goats tend to score consistently negatively (that is, below mean chance expectation [Palmer, 1982]). Participants' responses to these 'sheep-goat' questions could therefore also be investigated to see if the sheep-goat effect would be replicated, and also to explore whether sheep and goats differed in their responses to the prototype indicator of perceptual defence and vigilance.

The PIF questionnaire also contained some questions that might give some insight into the 'mental health' of potential participants, including questions about their sleep patterns (whether participants felt they usually got enough sleep), their participation in 'formal self-improvement programs' (such as psychotherapy), and whether they had experienced mental illness in the past (or at present). It was felt that these questions might be of interest for how they related to the measure of perceptual defence or vigilance: in other words, they might be able to say something about how an apparent tendency to be perceptually defensive or vigilant to emotive stimuli is associated with self-reported mental adjustment. A summary of the respective responses of perceptually defensive and vigilant participants will therefore be given later in this chapter.

Experiment 3 had made some attempt to increase the power of the study by selecting for analysis those participants whose mean brightness scores to the emotional slides were either highest or lowest (i.e. ranked 1 or 4) compared to those for the other slide categories, *in either half of the testing session*. It was felt that, for the light slides condition, this method had produced promising results, as 9 out of 11 participants in this condition showed apparent perceptual defensiveness or vigilance overall. It was decided for the current study to attempt to increase further the power of the study by adopting a more strict criterion for the inclusion of data in the main defensiveness-psi analyses. Only those participants who, *over the entire session*, responded most slowly or most quickly to the E slides compared to the other slide categories, would have their data included for the defensiveness-psi correlations. These would be designated 'criterion' participants, and it was decided in advance to continue the study until 24 individuals had responded according to this criterion. The data for all participants would be included in the remaining ESP and personality analyses.

Method

Overview of procedure

Individuals who had previously contacted the parapsychology unit expressing their interest in the subject and in helping with experiments were contacted and invited to participate. They were told that the study was to compare subliminal perception and extrasensory perception, and were given some details of the procedure. As with experiments 1, 2, & 3, participants were never deliberately misinformed about any aspects of the study, but care was taken to withhold details that might cue participants on the nature of the subliminal stimuli and the experimental hypotheses. Often this 'honesty with discretion' policy was achieved by describing aspects of the experiment in general terms, for instance: 'it is thought that people tend to respond similarly to subliminal and extrasensory perceptions'.

The volunteers took part in two testing sessions, usually about a week apart. The first session measured perceptual defence/vigilance using the method established in preliminary experiments reported earlier (further details below). In order to make the best use of both lab. time and participants' time, participants completed the EPI and R-S questionnaires at home between sessions. While this presumably introduced some variability in the conditions in which the questionnaires were completed, it was felt that, if anything, participants would be more relaxed and less self-conscious at home, and so they might answer the questionnaires more honestly than if they were in the lab. Participants then returned the questionnaires when they arrived for the second session that measured ESP (further details below). Participants were asked to bring in a friend to act as sender for the ESP session and most did so. For those few who did not bring in a sender, a student or staff member with the parapsychology unit acted as sender (with the participants' prior knowledge and consent).

The measure of perceptual defence/vigilance

As described earlier, individuals are asked to respond to weakly illuminated stimulus slides, some of which are emotionally unpleasant, by pressing a button when they first become aware of the presence of the slides. Preliminary experiments have shown that at this 'subjective awareness threshold' the participant reports no awareness of the presence of any information other than the overall rectangular shape of the slide. Fluctuations in the illumination level at which the participants report awareness of the slide may represent an index of their (possibly physiological) reactions to the subliminally-presented emotional, neutral, and control information, thus enabling them to be identified as perceptually defensive or vigilant. Individuals who respond, on average, most slowly to the emotional slides are regarded as perceptually defensive; those responding most quickly to the emotional slides are regarded as perceptually vigilant.

Stimuli for measuring perceptual defence/vigilance. These were identical to those used in experiment 3 - simple black and white line drawings, or jumbled up 'control' drawings: there were 4 emotional slides (E), 4 emotional control slides (EC), 4 neutral slides (N), and 4 neutral control slides (NC). The emotional slides had been chosen from a larger number which had been rated for emotionality; the slides rated as most emotional were selected. Whereas the emotionality rating for the E slides in experiments 1 and 2 was 5.981 (with a maximum rating of 7), that for the present study was 6.16 (as for experiment 3). (For purposes of illustration, appendix 6 shows the full set of stimuli that were used in experiment 7 of this thesis). Each slide was shown 4 times, so there were 64 stimulus exposures in total. Each participant had a different pseudo-random slide order.

The experimenter loaded the slides prior to the session, so it is possible she could remember the slide order. However, as she was blind to the participant's responses during the session, it was considered extremely unlikely that she could have nonverbally biased the participant's responses in line with her expectations. In order for such bias to take place, the experimenter would have to remember the numbered order of the 64 target slides, remember which slide contents were associated with each slide number, communicate the slide nature to the participant nonverbally and nonvisually (since the experimenter makes no comment while the participant is responding to a run of slides, and since the participant is looking into the dark box during each run of slides), and, further, while blind to the participant's scoring, to have communicated whether the participant should 'act defensive' or 'act vigilant' to the emotional slides in a manner that would produce a correlation in the expected direction with the participant's performance on a psi task that would take place the following week!

Apparatus for measuring perceptual defence/vigilance. As described in more detail earlier, the apparatus for presenting the subliminal stimuli is a modified two-field tachistoscope: one field, forming the background for the slide presentations, is constantly illuminated; the other field, within a carousel projector, gradually increases in brightness, thereby gradually illuminating a stimulus slide. The apparatus is known as Pandora's Box. A BBC computer controls stimulus presentation and illumination, and records the participant's responses to disk, keeping the experimenter blind to the participant's scoring. Participants respond by pressing a hand held button when they first become aware of the rectangular shape of the slide superimposed on the background field. Participants' subjective judgement about when to report awareness of the slide is known as their 'response criterion', which they are asked to keep as consistent as possible throughout the session. A random time delay prior to slide illumination introduces some variability in the timing of slide presentation, thus encouraging participants to respond according to their visual impressions rather than to their sense of anticipation. The computer program sets an upper limit to the slide brightness, which is intended to prevent the participant from accidentally or deliberately letting the slide brighten to the stage where the slide nature can be identified.

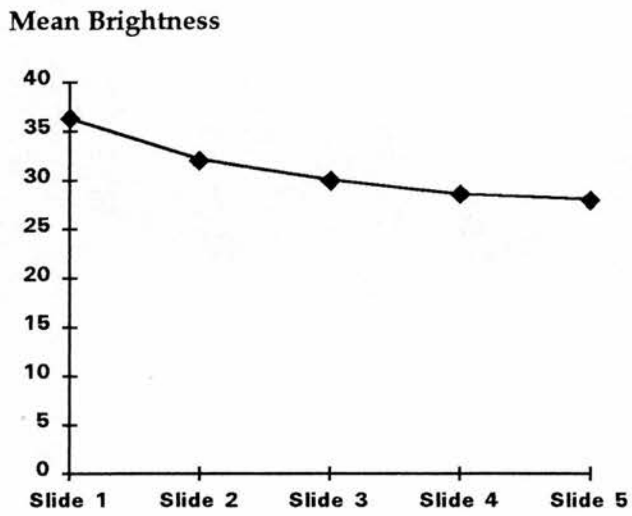
Procedure for measuring perceptual defence/vigilance

After initial conversation and refreshments the procedure was discussed. Without revealing details of stimulus nature or experimental hypotheses, the task was presented to participants as 'a sort of eye test, where I am measuring when you first see something, but where there are no right or wrong answers'. It was explained that while participants were attempting to respond consistently to each slide, it was only natural that there would be some variations in their responses, and I would be measuring these variations. Most participants accepted this rationale without question; those who wished more information were given more (for instance, they could be told that there was 'information' on each slide that they were not expected to be able to see consciously), but care was taken at this stage not to reveal the nature of the stimuli (that some of them were considered to be emotionally unpleasant, for instance) or specific hypotheses (that those who reacted relatively slowly to the emotive slides were expected to have relatively low ESP scores, for instance). No systematic records were taken of exactly what information was revealed to each individual participant, but the overall impression was that perhaps 90% of participants were satisfied with the initial explanation of the procedure; there was no impression that the more curious 10% performed any differently on the task than the others, though this was not formally tested.

Once initial queries had been satisfied, participants looked into Pandora's Box and were first shown a blank 'demonstration slide', to show them the shape and position of the rectangular light area to which they would subsequently be responding. They then did 5 practice slides, where the stimulus slide (containing a neutral rectangular shape that was reportedly not seen) gradually brightened and participants were required to press the response button when they could see the rectangular light area indicating the presence of the slide (an example of this practice slide is included in appendix 6). The experimenter (me) was able to see the brightness scores for these practice slides, and to give feedback to the participants on their responding. Feedback consisted of telling participants their brightness scores, and pointing out any trend in their scoring on the practice slides (for instance, scores were typically high to begin with, then decreased to a fairly steady level). Participants were usually assured by the experimenter that their performance in the practice slides was 'quite normal'; if the participant's scoring seemed unstable the experimenter gave further guidance on how to adopt a stable response criterion [for instance, to look for a sharp corner to the rectangle of light (the overall shape of the transparency) as a guide to when the stimulus had reached a certain brightness].

The aim of the practice slides was to enable participants to adjust to the visual experience, and to practice adopting a stable response criterion. Typically, participants' scores gradually decreased to a stable level around the 4th or 5th practice slide. Figure 6.1 shows the mean brightness scores for the 5 practice slides for the 48 participants in the present experiment; this graph verifies the gradual decline and stabilisation of participants' brightness scores over the practice slides. The standard deviation of brightness scores over the practice slides also declined (slide 1 SD=11.534, slide 2 SD=9.998, slide 3 SD= 8.324,

Figure 6.1
Mean brightness scores for the 5 practice slides in experiment 4, for all 48 participants



slide 4 *SD*=6.979, and slide 5 *SD*=6.751), thus indicating a gradual stabilisation of scoring.

When participants were quite clear about what they were being asked to do, we proceeded to do 4 runs of 16 experimental slides each, with a short (c. 2 mins) break after the 1st and 3rd runs, and a longer (c. 5 mins) break at the halfway point. The aim of the breaks, whose length was determined by participants, was to reduce the possible effects of tiredness or boredom on the results.

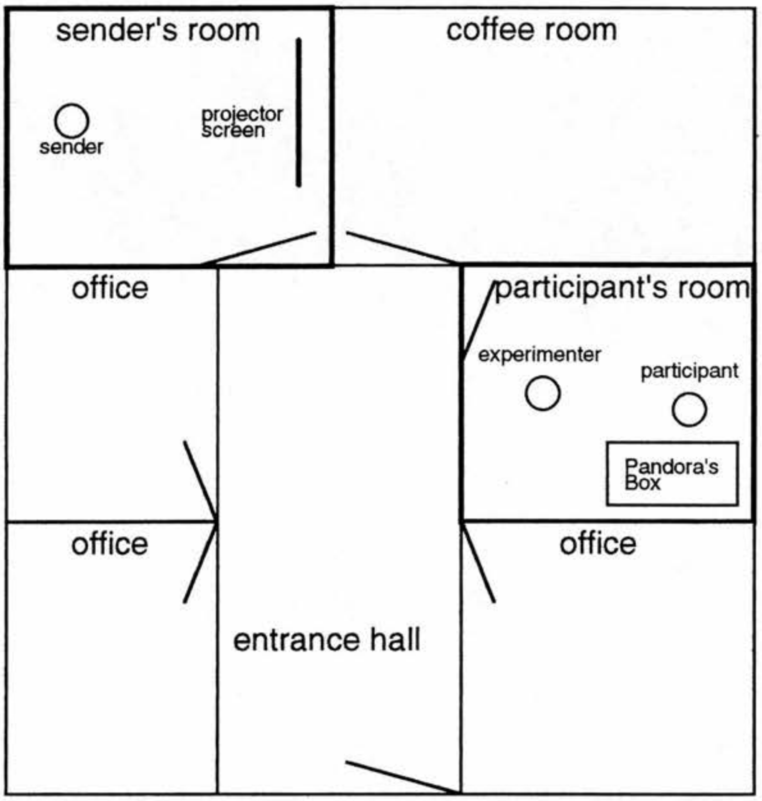
At the end of the slide presentations, participants were asked whether they had seen anything other than the rectangular light area which they were looking for. They were then shown a selection of the stimuli, and the aim of the procedure (to see whether individuals were perceptually defensive, vigilant, or neither) was explained. Finally, a description was given of the procedure for the second (ESP) session, so that the participant could inform a potential agent, or sender, of what to expect.

The measure of ESP

There were in fact two independent measures of ESP in the second session. The first, that may be called 'unconscious ESP', is an unorthodox measure that is designed for maximum similarity to the previous week's subliminal test. The second is a more traditional forced-choice ESP task (which may be called 'conscious ESP'), that is more similar to the subliminal perception task than has been the case for previous defensiveness-psi studies.

Overview of ESP measure. Figure 6.2 depicts the layout of the experimental suite and the location of experimenter, participant, and sender for the ESP session. The participant is seated in the partially sound attenuated experimental room, looking into Pandora's Box. Simultaneously, the sender is seated in a nonadjoining partially sound attenuated room, looking at a standard slide projection screen, upon which will be projected a sequence of 24 'target' slides. A different pseudo-random slide order is used for each participant (produced in the same way as the slide orders for the defensiveness-testing session, using the pseudorandom algorithm of the BBC computer to produce a number of possible target sequences that were noted down and placed in a manila envelope for later selection and loading), and the ESP slides are loaded by someone otherwise uninvolved with the experiment. The slide tray cover is opaque, so the sender, participant, and experimenter cannot inadvertently glimpse the ESP targets. The experimenter

Figure 6.2
Layout of the experimental suite, including location of sender, participant, and experimenter for the ESP testing session



remains blind to the ESP target order, so cannot consciously or unconsciously bias the scoring.

The BBC computer is linked not only to Pandora's Box, but also to the slide projector in the sender's room (through ducting for electronic cabling), such that every time the participant presses the button to change a slide within Pandora's Box, the slide projector in the sender's room also changes a slide.

In a crucial difference to the previous week's session, the slides that are projected within Pandora's Box are blank, whereas those that the sender sees are either neutral (a plain drawing of a rectangle) or emotionally unpleasant. Thus, while the participant is responding to a blank slide within Pandora's Box (so far as the participant is concerned, the slides look no different from the previous session when each slide conveyed some information), the sender is simultaneously looking at a slide (at full illumination) which is either neutral or emotional.

Unconscious ESP measure. For the first measure of ESP (unconscious ESP), the participant simply responds to the blank stimulus slide according to the same criteria for the previous session. That is, they allow the slide to brighten until they can see a light rectangular shape, they press the button, and they try to be as consistent as possible in their judgements of when to respond to each slide. Simultaneously, the sender is looking at a neutral or an emotional slide.

If there were no ESP, then any variations in the participants' brightness judgements for identical blank slides should be quite random; if there were ESP, then you would expect the participant to respond differently to the blank slide depending on whether a neutral or emotional slide is being viewed concurrently. That is, there would be some signs of differential responding to blank slides depending on the nature of the target slides. For this experiment, participants are aware that there is some possibility that their responses to the blank slides may be related to the nature of the ESP target slides, but they are asked to try to ignore this possibility, concentrating like the previous week on responding consistently. In other words, participants were discouraged from thinking about this first response as an ESP measure.

Forced-choice ESP measure. Once participants have pressed the button to indicate they have seen the blank slide, the slide fades away; then, instead of the computer automatically advancing on to the next slide, as happened in the previous session, there is a pause while the participant considers the nature of the slide the sender is viewing. This is the second, forced-choice, or conscious ESP measure.

Participants may take as long as they like, and may adopt any strategy they like (short of physically visiting the sender's room to take a peek at the screen), to come to a conclusion about whether the sender's slide is neutral or emotional. Note that although their own (blank) slide has faded away, the sender's slide is still seen by the sender. The experimenter, who remains with the participant throughout, records the participant's choice manually on a printed response sheet. The participant is asked to indicate two things for the conscious ESP task: 1. whether the target is emotional or neutral (a two-choice ESP task, with a 50% likelihood of a correct guess by chance alone); and, 2. whether their decision is based on a feeling or impression about the nature of the slide, or whether they are simply guessing. The rationale behind asking participants to state whether or not they were guessing was that if participants scored more highly when they reported they had 'impressions' than when they were 'guessing', this would suggest that people may have some insight into when they are responding to ESP impressions; this was felt to be an interesting question that could readily be studied using the present methodology. When participants have recorded their choice with the experimenter, and they are ready to proceed to the next slide, they press the response button and this advances the sender's slide and their own slide and the two-stage process begins again.

Prior to the start of the ESP session, participant, sender, and experimenter chat together about ESP in general, and about the session in particular. The sender is given advice on how to send. Their goal is to help the participant make the correct decision about what kind of target the sender is viewing: emotional or neutral. For the neutral target the sender is asked to try to remain calm and peaceful, giving the message to the participant that there is nothing of consequence to this target. For the emotional target, the sender is asked to attempt, like an actor, to experience the emotion portrayed, so that the participant will pick up the message that this target has some emotional impact.

There are two sets of 12 ESP slides, with a rest break at the half-way point. It was decided to use only 24 experimental slides (compared to the 64 used for the defensiveness testing session) for the following reasons: 1. there would be only two kinds of stimuli for the ESP session - emotional and neutral - compared to the four kinds (E, EC, N, & NC) used for the defensiveness testing session; 2. with a forced-choice ESP experiment where there are only two possible target types, there is a risk of the sender, the participant, and the experimenter, becoming bored or tired with the procedure (and such motivational factors have been shown to be related to declining ESP performance, Palmer, 1978); it was felt that with only 2 short runs of 12 trials, the novelty of the procedure was less likely to wear off and thus depress ESP scores.

Once all 24 slides have been responded to, the experimenter and the participant rejoin the sender and all three view the ESP slides, so that the participant gets immediate feedback on their forced-choice ESP performance.

The experimenter records the correct guesses ('hits'), and these are later double-checked. The participant and sender exchange their thoughts about the session and the targets, and the experimenter answers any further questions they may have. The session ends with a promise to send the participant details of the outcome of the study when the analysis is completed.

Stimuli for ESP measure

1. Participant's stimuli. Just as with the defensiveness testing session, the participant first responds to 1 demonstration (blank) and 5 practice slides (each depicting an identical simple black and white drawing of a rectangle), to refamiliarise themselves with the task of pressing the button when they first see the light rectangular slide shape within Pandora's Box. The practice slides are followed by 24 identical blank slides, presented in two runs of 12, with a short (c. 5 mins) break at the half way point.

2. The question 'what are the characteristics of a successful ESP target?' has yet to be answered by parapsychologists, though there is some agreement on what target dimensions may be important in this respect - for instance degree of complexity, degree of familiarity/novelty, and the degree to which the target is dynamic (e.g. a film clip) or static (e.g. a still picture) (Delanoy, 1989; Watt, 1989; Honorton et al., 1990). For the present study, synchronised with the participant's slides, the agent sees 6 slides identical to the participant's practice slides, and then 24 slides (the ESP targets), 12 of which have previously been judged to be of negative emotional tone, and 12 of which show a neutral rectangle (identical to that used for the practice slides). Because of my interest in what makes a good ESP target, the 12 emotional

slides are composed of 3 separate slide sub-categories: 1. Familiar Simple (FS) - 4 simple black and white line drawings, as previously used in the defensiveness testing session (mean emotionality rating 6.16); 2. Unfamiliar Simple (US) - 4 simple black and white line drawings not previously seen by the participant (these were rated for emotionality together with the FS slides in prior pilot work, mean emotionality rating 5.83); and, 3. Complex - 4 colourful slides developed for use by the Maimonides Dream Laboratory (these were rated for emotionality separately from the simple black and white line drawings, being presented together with another 23 Maimonides slides to 13 individuals; the mean emotionality rating of the 4 selected slides was 5.86). The 8 simple targets were chosen because of their similarity to the Emotional stimuli used for the defensiveness testing situation (the underlying assumption being that by maximising the similarity between features of the defensiveness testing session and the ESP testing session one may maximise the likelihood of a correlation emerging between participants' responses to the stimuli in each session). The 4 complex slides were included because they contrasted physically with the simple slides, yet had similar emotionality ratings to them; by using complex emotional target slides, therefore, one might address the question of whether target complexity or target emotionality was most associated with successful ESP performance.

Hypotheses and Exploratory Questions

The main hypotheses of this study concerned the relation between apparent perceptual defensiveness/vigilance and ESP. It was decided in advance to include in these analyses only those participants whose responses to E slides on Pandora's Box compared to the other 3 slide categories were either slowest (indicating defensiveness) or quickest (indicating vigilance). It was planned to terminate the experiment when 24 individuals had passed this 'criterion' (hereafter referred to as 'criterion' participants). The data from all participants would be included in the remaining exploratory analyses. While 4 categories of stimuli are used for the measure of perceptual defence/vigilance (E, EC, N, & NC), the analyses will contrast scoring on Emotional slides with scoring on the matched Emotional Control slides. This is because it is important to establish whether any differential scoring on the E slides is due to the emotional meaning associated with the slides or to the physical characteristics of the slides (for example, their brightness, or the number or size of shapes they depict). The EC slides served the function of controlling for the overall physical characteristics of the E slides, by having the stimulus information cover approximately the same area as the E slides and by having the same light transmitting properties as the E slides. The EC slides, as they looked simply like jumbled shapes and lines, might be considered analogous to 'nonsense words' used in earlier perceptual defence experiments, and might also be regarded as 'neutral' stimuli, as would N and NC slides. The main function of N and NC slides, then, was to enable a spread of scoring, so that one could select for analysis those whose scores were relatively extreme: brightness scores for E slides could be ranked in comparison to three other sets of 'neutral slides' (that is, EC, N, & NC). As will be discussed in the conclusion of this thesis, however, the role of the N and NC slides, and the necessity to include them at all, could be questioned.

Hypotheses 1 and 2 address the main concern of this experiment - the relationship between scores on the prototype measure of perceptual defence/vigilance and ESP performance.

H1. There will be a significant correlation between responses to Emotional (but not Emotional Control) slides during the defensiveness testing session and conscious (forced-choice) ESP scores, such that apparently defensive individuals score relatively poorly at conscious ESP while apparently vigilant individuals score relatively well at conscious ESP.

H2. Predicts a significant correlation in the same direction as for H1, between apparent defensiveness/vigilance and unconscious ESP (as indicated by the participants' brightness scores for blank slides while simultaneously ESP targets slides are being viewed by a sender).

Hypotheses 3, 4, and 5 concern the relationships between Byrne's Repression-Sensitization (R-S) scale (Byrne, 1961; Byrne, 1964; Byrne, Barry, & Nelson, 1963), the prototype indicator of perceptual defence/vigilance, and ESP. Earlier it was noted that, on the face of it, 'repression' resembled perceptual defence and 'sensitization' resembled perceptual vigilance. If this were so, then one might expect R-S scores to correlate with perceptual defence/vigilance scores, and also to correlate with ESP in the same way as perceptual defence/vigilance might. These hypotheses are, however, based on the assumption that one cannot be 'perceptually defensive' and, simultaneously, 'perceptually vigilant', or 'repressing' and, simultaneously, 'sensitizing': are these concepts ranged along single dimensions, or orthogonal to one another? The literature does not as yet answer this question, and there seems to be a need for conceptual clarification; Byrne, for instance, regards both repression and sensitization as indicative of defensiveness, but the scoring scheme for the R-S scale does not permit one to be, simultaneously, both a repressor and a sensitizor. The definition of perceptual defence and perceptual vigilance within the subliminal perception paradigm also does not permit one to be both defensive and vigilant at the same time. It has been suggested, though, that defensiveness and vigilance may lie on an 'inverted-U' curve so that, as subliminal stimulus emotionality changes, an individual's threshold regulation may change from defensive to vigilant, or vice versa (Brown, 1961; Dixon, 1981). For present purposes, therefore, one must adopt the position that, since the scoring used for the prototype measure of perceptual defence/vigilance and the R-S scale do not permit the identification of individuals as both defensive/repressing and vigilant/sensitizing, we should treat these concepts as uni-dimensional. At the same time, however, it should be noted that this assumption is made for pragmatic purposes, and that further research is needed on the conceptualisation of defensiveness and vigilance.

H3. There will be a significant correlation between brightness scores for E (but not EC) slides in the defensiveness testing session and scores on the Repression-Sensitization (R-S) scale, such that apparently defensive individuals on Pandora's Box are also apparently 'Repressors' on the R-S scale, while apparently vigilant individuals are also apparently 'Sensitizors' on the R-S scale.

H4. There will be a significant correlation between R-S scores and conscious (forced-choice) ESP scores such that relatively 'Repressive' individuals will tend to score relatively poorly at conscious ESP while relatively 'Sensitive' individuals will tend to score relatively well at conscious ESP.

H5. Predicts a significant correlation in the same direction as for H4, between R-S scores and unconscious ESP.

Exploratory questions included: would there be overall significant ESP scoring?; what is the relationship, if any, between apparent defensiveness/vigilance and EPI scores?; what is the relationship between R-S score and EPI scores?; is there any difference in ESP scoring for the different emotional slide types?; is there any difference between ESP scores when the participant's call was a 'guess' than when it was based on an 'impression'? How does belief in psi relate to ESP and personality scores? The data might suggest further exploratory questions.

Results and discussion

Forty-eight individuals took part in the study (mean age 39, range 19-66 years). Of the 24 criterion participants, 10 were apparently defensive (3 males, 7 females), 14 were apparently vigilant (2 males, 12 females), and the remaining 24 'non-criterion' participants consisted of 15 males and 9 females. Males and females were unevenly distributed on the measure of perceptual defence/vigilance (χ^2(2df)=9.614, p<.02), with the greatest imbalance due to there being only 2 vigilant males, compared to 12 females; there was also a disproportionate number of males (15) who failed to show strong signs of defensiveness or vigilance compared to females in this category (9). Participant Information questionnaires were completed by all but one of the participants (a 'defensive' male), so the results below for belief in ESP (sheep-goat scores) and for questions related to 'mental health', are for 47 individuals. The other questionnaires were completed by all participants.

Table 6.1

Spearman correlation coefficients between scores on Pandora's Box (rank E and rank EC slides), ESP scores, and Repression-Sensitization (R-S) scores

	Rank E Slides	Rank EC slides	R-S
Conscious ESP	.192	-.069	.088
Unconscious ESP	.269	-.398	.088
R-S	-.361	.016	

Main hypotheses

Table 6.1 shows the (Spearman) correlation coefficients between Rank E and Rank EC slides, and conscious ESP, Unconscious ESP, and R-S scores, for the 24 criterion participants. While defensiveness/vigilance correlated in the expected direction with ESP performance (r_S=.192 for conscious or forced choice ESP; r_S=.269 for unconscious ESP), this correlation was not statistically significant, so there was only weak support for Hypotheses 1 and 2. As expected, there was only a very small correlation (r_S=-.069) between EC brightness scores and conscious ESP performance, but surprisingly there was a sizeable correlation (r_S=-.398, ns, 2-t) between EC score and unconscious ESP. It is difficult to know how to interpret this last finding, though one should note that the rank of mean EC scores is not independent from that of E scores: for instance, if E slides are ranked 1 overall then the possible range of ranks for EC slides is restricted to 2, 3, or 4. Therefore if there is a sizeable correlation in one direction between rank E scores and ESP, there would be a tendency for a correlation in the opposite direction for rank EC scores and ESP.

As one may question the validity of calculating a correlation coefficient on crudely-ranked scores on the subliminal perception task (since there are only 4 possible ranks), *t*-tests were calculated comparing the ESP scores for defensive and vigilant participants. On conscious ESP, t=-.773, therefore the difference between forced choice ESP scores for individuals who were apparently perceptually defensive and individuals who were apparently vigilant is in the predicted direction but not significantly so. For unconscious ESP, t=-1.634, p=.059, 1-t; therefore there is a statistically significant difference in the unconscious ESP scores of 'defensive' and 'vigilant' individuals, in the predicted direction.

How does the defensiveness/ESP correlation change when the data of all participants is included, rather than that of those who scored most extremely on defensiveness/vigilance? For conscious ESP, as one might expect, the correlation is weakened, though still in the predicted direction: r_S=.149 for E slides, r_S=-.117 for EC slides. The same applies for unconscious ESP: r_S=.257 for E slides; r_S=-.325 for EC slides; with n=48, the last correlation is statistically significant (p<.05, 2-t).

The correlation of -.361 between defensiveness/vigilance and Repression-Sensitization scores is opposite to the predicted direction for which a one-tailed test of probability had been planned, and therefore is not statistically significant. Thus, those who were 'Sensitizors' were apparently perceptually defensive; 'Repressors' tended to be perceptually vigilant. A *t*-test of the difference between defensive and vigilant participants' R-S scores gives t=1.970, p=.069, 2-t. Hypothesis 3 was therefore not supported.

Hypotheses 4 and 5 predicted significant correlations between Repression-Sensitization and ESP. Table 6.1 shows that there was no sizeable relationship between these measures (r_S=.088 for both forced choice and unconscious ESP), thus hypotheses 4 and 5 were not supported.

Exploratory questions

Unless otherwise indicated, the following analyses were conducted on the data of all 48 participants. Personality measures will be considered first, then ESP results, and finally sex differences.

Personality measures

Scoring on Eysenck's Extraversion ranged from 2 to 19, with a mean of 11, and a Standard Deviation of 4.2; Neuroticism scores ranged from 1 to 23, with a mean of 10.5, *SD*=5.6; and Repression-Sensitization scores ranged from 3 to 102 (with high scores indicating sensitization), with a mean of 39.9, *SD*=22.2.

Table 6.2 shows the correlations between Eysenck's extraversion and neuroticism, and R-S, ESP, and defensiveness/vigilance. The table has several items of interest. While extraversion did not appear to relate to defensiveness/vigilance (and there was no sizeable correlation between extraversion and responses to EC slides), neuroticism did show a strong significant correlation with defensiveness/vigilance (r_S=-.381, p<.01, 2-t) (more defensive, more neurotic), while the correlation for EC slides was

Table 6.2
Spearman correlation coefficients between extraversion, neuroticism, ranked brightness scores for E and EC slides, R-S scores, and ESP scores

	Extraversion	**Neuroticism**
Responses to E slides	.099	-.381[1]
Responses to EC slides	-.064	.238
R-S score	-.523[2]	.766[2]
Conscious ESP	-.276	-.078
Unconscious ESP	.011	-.018

[1] $p<.01$, 2-t
[2] $p<<.01$, 2-t

not statistically significant. It will be recalled that experiment 2 also showed a correlation between defensiveness/vigilance and neuroticism (r_S=-.145); thus this experiment provides confirmation for this relationship, where individuals with relatively high neuroticism scores tended to be perceptually defensive. This is perhaps an encouraging sign that there may be some validity to the Pandora's Box technique for identifying perceptually defensive/vigilant individuals, since both neuroticism and perceptual defence might be viewed as maladaptive responses to anxiety (or, more neutrally, as similar ways of reacting to stress). Kreitler & Kreitler (1990) point out that 'more theoretically oriented discussions of repression emphasize favorably its status as a major element of a *neurotic* personality style (p.559), and defensiveness is considered to be an important factor in *repression* (defined by Weinberger et al., 1979, as low anxiety, high defensiveness); Kline, too, would consider repression to be related to defensiveness (e.g. Cooper & Kline, 1986).

The apparent lack of relationship between extraversion and defensiveness/vigilance found in this study also confirms the findings of experiment 2, and the nonsignificant correlation for EC slides in this experiment (with 48 participants) casts doubt on the significant correlation found in experiment 2 (r_S=.817) (with only 7 participants).

Since the exploratory analyses reported in table 6.2 were calculated with the data of all participants, it is interesting to look at the criterion participants' data to see whether the above trends are stronger for those individuals defined as perceptually defensive or perceptually vigilant. The correlation between perceptual defence/vigilance (E slides ranked 1 or 4) and extraversion is .105, while that for EC slides is -.018. A *t*-test comparing extraversion scores for defensive individuals (E ranked 1) with those for vigilant individuals (E ranked 4) gives t=-.673, p=.508. Thus there is no indication of a stronger relationship between extraversion and defensiveness/vigilance for the criterion participants compared to all participants. The correlation between defensiveness/vigilance (responses to E slides) and neuroticism for the criterion participants is -.478 (p<.01, 1-t), while that between the control (EC) slides and neuroticism is only .110. A *t*-test comparing the neuroticism scores for defensive individuals with those for vigilant individuals gives t=2.776 (p=.015, 1-t). Thus, as one might expect, the relationship between defensiveness/vigilance and Eysenck's neuroticism is greater for those individuals who showed the most extreme responses to the emotional subliminal stimuli than it is for all participants.

Table 6.2 also shows that the Repression-Sensitization scale correlated very highly with the EPI: r_S=-.523 for extraversion (p<<.01, 2-t; repressors more extraverted); and r_S=.766 with neuroticism (p<<.01, 2-t; repressors less neurotic). The magnitude of the latter correlation especially throws doubt over what exactly the R-S scale is measuring, and should be taken into account when interpreting the outcome of the test for hypothesis 3.

Extraversion showed a marginally non-significant correlation (r_S=-.276) with ESP, such that extraverts scored relatively poorly at conscious ESP (with only a very small correlation for unconscious ESP, r_S=.058). A recent meta-analysis of extraversion and ESP performance (Honorton, Ferrari, & Bem, 1991) found a significant correlation (N=11 studies, r=.21, p=.000005) for free-response ESP performance, with the more extraverted scoring more highly at ESP. The meta-analysis also found that the correlation between forced choice ESP performance and extraversion was an artefact of order of completion, with there being no relationship (N=16 studies, r=-.02) when (as with the experiments reported in this thesis) extraversion was assessed prior to the participants receiving knowledge of their ESP scores. This study goes further, to suggest a slightly negative relationship between forced-choice ESP performance and extraversion; evidently there is a need for further investigation of the ESP-extraversion relationship, and follow-up experiments in this thesis will continue to take 'artefact-free' extraversion measures to look at this question. One might also have to consider how comparable the forced choice measure of ESP in the present experiment is to those in the studies reviewed by Honorton et al.

Table 6.2 also shows that there was no correlation between neuroticism and either ESP measure. A 'vote counting'-style review by Palmer (1977) found 18 out of 24 series showed a relationship between neuroticism and ESP in the predicted direction (neurotic individuals tended to score poorly at ESP). At first inspection, then, the current experiment appears to be a failure to replicate Palmer's finding. However, Honorton et al. (1991) caution that, as with the forced-choice ESP and extraversion studies, it is possible that the neuroticism-ESP relationship is an artefact of the order in which the personality and ESP measures were taken. In the light of this caution, the present results (which are free from the order artefact) add weight to the call for a re-examination of the neuroticism-ESP studies.

Finally, it will be recalled that 37 out of the 38 participants completed the Participant Information Form, which included some questions about belief in and experience of psi. Scoring on these 'sheep-goat' questions ranged from 22 to 47.5 (with high scores indicating high belief in and experience of psi), with a mean score of 34.2 (SD=5.9). Sheep-goat scores were correlated with the other major measures taken in this study. There was a nonsignificant tendency for believers in psi ('sheep') to be more extraverted than disbelievers in psi ('goats') (r_S=.135), and there was no correlation between neuroticism and belief in ESP (r_S=.082). There was also little relationship between belief in ESP and responses to the measure of perceptual defence/vigilance (r_S=-.012 for E slides; r_S=-.165 for EC slides).

ESP Results

1. *Forced Choice ESP performance.* Table 6.3 gives the results for all participants' forced choice ESP performance, plus a breakdown into the categories of defensive, and vigilant participants. Z-scores were calculated for those trials when participants said they had an 'impression' of the target nature, and for those where they were guessing. Looking at slide type, Z-scores were calculated for emotional and neutral slides, for a breakdown of the three emotional slide types: familiar simple (FS), unfamiliar simple (US), and complex; and (collapsing FS and US scores, which are not significantly

Table 6. 3
Forced choice ESP results (Z-scores)

	All	Defensive	Vigilant	Male	Female
Overall ESP	.059	-.907	.055	-.457	.504
'Impressions'	.634	-.636	.882	-.769	1.517
'Guesses'	-.817	-.562	-1.341	.249	1.375
Emotional	-.836	-.552	-.466	-1.167	.055
Neutral	1.361	-.642	.621	.453	.825
Familiar simple	-1.016	-.649	-1.361		
Unfamiliar simple	-1.231	-.481	-.135		
Simple	-1.686	-.905	-1.145		
Complex	.800	.160	.674		

different), simple emotional slides. Table 6.3 also gives basic results for male and female participants.

None of these ESP results is significant at the two-tailed level. Some suggestive trends will be noted, however, as these may be related to previous research findings, and may yield predictions for follow-up experiments.

Overall conscious (forced-choice) ESP scores were at chance levels, but those calls described as 'impressions' scored positively, while those described as 'guesses' scored negatively. There is some suggestion, therefore, that participants are able to discriminate between successful calls and unsuccessful calls (even though participants were rarely confident of their impressions). There is little precedent in the parapsychological literature for asking participants to report their phenomenological experience of whether a forced choice call is an impression or a guess. However, one study (of which I learned after the completion of this experiment) has used a similar method

(Honorton, 1987). In this experiment, the participant was asked to report whether his call was an impression ('your choice was based on a distinct cognitive impression such as an image or verbal association'), a feeling ('you had no cognitive impression, but felt drawn to your choice'), or a guess ('your choice was based neither on an impression nor a feeling. You cannot identify any specific reason for your choice'). Honorton found that significant psi-hitting occurred when the participant's calls were based on impressions, but not when they were based on feelings or guesses. The finding in the present study that impressions scored higher than guesses is therefore in broad agreement with a previous similar study, though in the present study the response category 'impression' would include both 'impression' and 'feeling' as defined by Honorton. 'Feeling' calls nevertheless scored more highly than 'guesses' in Honorton's study.

Price (1990) remarks that in subliminal perception experiments requiring participants to make forced-choice discrimination judgements about the presence or absence of a weak stimulus, there has been little exploration of the participants' phenomenological experience associated with their responses. In what was probably the first subliminal perception study of its kind, Price used questionnaires and semi-structured interviews to examine what participants' experiences were when they reported they were guessing. He found that there was a wide variation in reported experiences for guesses, ranging from the participant having no idea why they made their guess, to the participant having some partial sensory cues (e.g. visual impressions) from the stimulus. In conversation with the participants in my experiments, I too have found that, despite the recommendations I have made as to what constitutes a guess and what constitutes an impression, participants vary widely in their personal criteria for labelling their responses as impressions and guesses. Belief in ESP seems to be an important factor here: as one might expect, 'goats' tended to describe more of their calls as 'guesses' than sheep (r_S=-.260, ns, 2-t), and sheep called more 'impressions' than goats (r_S=.260), perhaps suggesting a calling bias. In the introduction to this chapter the 'sheep-goat effect' was described - the tendency for sheep to score positively at ESP tasks, whereas goats tend to score negatively. This study did not replicate the sheep-goat effect because there was no correlation between sheep-goat scores and ESP scores (r_S=.031).

Scoring on familiar simple emotional slides was not significantly different than for unfamiliar simple emotional slides (both scored negatively); the highest scoring, however, was for the complex emotional slides. Previous investigations of the characteristics of successful ESP targets (e.g. Delanoy, 1989; Watt, 1989; Honorton & Schechter, 1987) suggest that rich ESP targets elicit relatively high ESP scores. So, although the present trend is not statistically significant, it is in accord with previous research findings.

There is less agreement over whether emotional or neutral targets are associated with higher ESP scores; in this study scoring tended to be negative for the emotional targets and positive for the neutral targets. A slight calling bias existed over all participants, with slightly fewer calls for emotional targets (n=550 calls) than for neutral targets (n=595 calls). This would be expected to contribute to the trend of negative scoring for emotional targets, since, by chance alone, there were fewer calls for these targets than for the neutral targets so that there would be slightly less chance of scoring a 'hit' for the emotional than for the neutral targets. Defensive participants scored negatively for both kinds of target whereas vigilant participants scored negatively for emotional targets and positive for neutral targets. This latter trend does *not* seem to be caused by a calling bias since the 10 defensive participants called 'emotional' on average 11.9 times in a session and the 14 vigilant participants called 'emotional' on average 11.4 times in a session so that, by chance alone, one would expect defensive participants to have scored slightly more highly on emotional targets than vigilant participants.

Looking at sex differences in ESP performance, males tended to score negatively, and females tended to score positively. The highest scoring was for females when they felt they had an impression of the target and the lowest scoring was for females when they reported they were guessing; males did the reverse, scoring negatively on 'impressions' and slightly positively on 'guesses' (perhaps this trend gives some support to the popular notion of 'female intuition').

Finally, there was little relationship between participants' age and their ESP performance (r_p=-.057), but those who participated early in the study tended to have lower ESP scores than those who participated later in the study (r_p=.278, p=.056, 2-t), thus the ESP scores in this study improved slightly as the study progressed, in contrast to the 'decline effect' that is sometimes seen with forced choice ESP studies.

2. *Unconscious ESP.* It will be recalled that participants indicated when they first became aware of the presence of blank slides, while simultaneously the sender was viewing the ESP target slides. It was decided that these brightness scores might be a novel indicator for 'unconscious' or 'implicit' ESP, contrasting with the conscious cognitive effort which characterised the forced choice ESP task. Mean brightness scores for emotional ESP targets were compared with those for neutral ESP targets; it was decided that,

regardless of which gave the higher or the lower brightness scores, the *magnitude* of the difference in scoring for the two target types might be related to degree of ESP. Thus a relatively large difference in brightness scores would indicate more ESP than a relatively small difference in brightness scores. The reason for adopting *magnitude* (rather than *direction*) of difference in brightness scores as the unconscious ESP measure was that of avoiding any possibly unwarranted assumptions about the directionality of unconscious ESP scoring (for instance, all participants favouring E over N slides, or vigilant favouring E over N, or vice versa).

It was found that, for all participants, there was a non-significant correlation in the expected direction between unconscious ESP and perceptual defensiveness/vigilance (r_S=.257; defensive individuals showed less discrimination in their brightness scores than did vigilant individuals); puzzlingly, however, there was a significant correlation between unconscious ESP and responses to the subliminal emotional control slides (r_S=-.325, p<.05, 2-t). Looking at this correlation for only the 24 criterion participants, there was, as one might expect, a slightly higher correlation between defensiveness/vigilance and unconscious ESP (r_S=.269, ns); once again, though, the correlation for EC slides was higher still (r_S=-.398), though this time it was not statistically significant. A *t*-test comparing unconscious ESP scores for the 10 perceptually defensive participants with those for the 14 perceptually vigilant participants gave t=-1.634, p=.059, 1-t). Thus, the unconscious ESP-defensiveness correlations are encouraging but only marginally statistically significant. It is not clear, however, how to explain the larger correlations between unconscious ESP and responses to subliminal control slides; as mentioned earlier, one factor to bear in mind is that the ranked scores for E slides are not statistically independent from those for EC slides.

A final question relates to the validity of this unusual ESP measure. One way of looking at this is to correlate unconscious ESP scores with conscious (forced choice) ESP scores: one would expect the two to correlate positively, and indeed this is the case (r_p=.540, p=.000074, 2-t). This is an important finding, because it suggests that the novel measure of unconscious ESP may be measuring the same or a related phenomenon to the forced choice or conscious ESP measure. Thus even though overall scoring on the two measures was not suggestive of ESP, there are internal patterns and consistencies in the ESP data that suggest meaningful ESP scoring.

Summary and Conclusions

This study explored the relationship between defensiveness as indicated by a novel measure of perceptual defence/vigilance and: conscious ESP as measured by forced choice responses to emotionally negative or neutral slides; and unconscious ESP as measured through fluctuations in subjective awareness thresholds for blank slides while emotional or neutral slides were simultaneously being viewed by a sender.

None of the main hypotheses of this study was significantly confirmed, though the data showed some suggestive trends in the expected directions. There was only a modest correlation between apparent defensiveness/ vigilance and conscious ESP (r_S=.192 for criterion participants; r_S=.149 for all participants); it is encouraging, however, that this correlation is in the predicted direction, that it is greater for those participants identified as more extremely defensive or vigilant, and that it is greater than the correlation for the meaningless emotional control slides. There was a moderate correlation between apparent defensiveness/vigilance and the novel measure of unconscious ESP (r_S=.269 for criterion participants; r_S=.257 for all participants). Again, this was in the expected direction, and again it was greater for the selected criterion participants than for all participants. However, participants' responses to EC slides also correlated moderately with unconscious ESP (r_S=-.398 for criterion participants; r_S=-.325 for all participants). While the ranked mean brightness scores for EC slides are not independent of those for the E slides, one would not expect there to be higher correlations for the control slides than for the critical slides, unless random variation in the data happened to be consistent with the trend thus contributing to the effect size.

Apart from this unexpected finding, these results suggest that the 'Pandora's Box' methodology may be a promising tool for examining the relationship between defensiveness/vigilance and ESP performance - the correlation found in this study compares favourably with that found in the meta-analysis of DMT-ESP studies reported in chapter 2 (r_S=.16 for all 16 studies). However, the number of participants in the present study was much smaller than for the DMT-ESP studies as a whole, so as yet the DMT-ESP correlation must be regarded as more reliable than that found for the present study.

Further support for validity of the prototype measure of perceptual defence/vigilance being examined in this thesis comes from the statistically significant neuroticism-defensiveness correlations: for all participants r_S=-.381; for criterion participants r_S=-.478. It is encouraging that these correlations are in the expected direction, that there is a stronger correlation for the participants identified as more extremely perceptually defensive/vigilant, and that the correlations for the EC slides were smaller and non-significant. I am not aware that earlier measures of perceptual defence or vigilance have been consistently related to neuroticism. Certainly, performance on the DMT is generally found to be unrelated to the other major personality factors (e.g., Haraldsson & Houtkooper, 1992).

So far there has been no consideration of those questions in the Participant Information Form (completed by all but one of the participants in the present study) that may suggest something about the self-reported 'mental health' of participants. The questions that were judged to be of particular interest here (based on the advice of a clinical psychologist, Dr. Ian Tierney) were those relating to sleep disturbance, participation in 'formal self-improvement' programs (e.g. psychotherapy), and experience of 'mental disorder'. I also felt that if there was some indication that participants had practised some 'mental discipline' (such as meditation, relaxation, or hypnosis), then this would imply that there had been a perceived need for such mental discipline, which could suggest that participants felt that their mental health could be improved. Once I knew participants' responses to the prototype measure of perceptual defence, I felt, with the benefit of hindsight, that many of the 'defensive' participants were in my opinion less 'well-adjusted' than the 'vigilant' participants. It was decided, therefore, to see if there would be any support for this impression, by looking at participants' responses to the participant information questionnaire and contrasting the 'defensive' and 'vigilant' participants' responses to those questions that might be relevant to mental health. Table 6.4 give details of participants' responses to these questions.

Table 6.4

Responses to Participant Information Form questions on mental health, for perceptually defensive and perceptually vigilant participants (details of each question are given below the table).

	Mental Discipline?	Formal Self-Improvement?	Regular Sleep?	Hours of Sleep	Enough Sleep?	Mental Disorder?
'Perceptually Defensive'						
	Meditation/ Relaxation	Psychosynthesis	Yes	9	Yes	-
	Hypnosis	Yes (no details)	No	7	Yes	-
	Relaxation/ Meditation/ Hypnosis	Psychotherapy	No	5	Yes	Depression/ Anxiety
	Relaxation	No	Yes	7.5	Yes	-
	Meditation	No	No	6	No	-
	-	No	Yes	8	Yes	-
	Meditation/ Relaxation	Psychotherapy	Yes	7.5	Yes	-
	Meditation/ Relaxation	No	Yes	8.5	No	Yes (no details)
	Relaxation	Psychodrama/ TA	Yes	6	No	-
'Perceptually Vigilant'						
	-	No	Yes	8.5	Yes	-
	Meditation	No	Yes	8	Yes	-
	-	No	Yes	7.5	Yes	-
	Hypnosis/ Relaxation	Psychotherapy	No	4.5	Yes	Yes (no details)
	Meditation	No	Yes	7.5	Yes	-
	Meditation/ Relaxation	No	No	8	'Yes?'	-
	-	No	Yes	6.5	Yes	-
	Meditation/ Relaxation	No	Yes	8	Yes	-
	Relaxation/ Autogenics	No	Yes	7	Yes	-
	Relaxation/ Meditation	No	Yes	7	Yes	-
	-	No	Yes	8	No	-
	-	No	No	7	Yes	-
	Relaxation	No	Yes	8	No	-
	-	TA	Yes	7	No	-

The 'mental discipline' question was: 'Have you ever practised any form of mental discipline/exercise, e.g. meditation, biofeedback, hypnosis, relaxation exercises?' The 'self-improvement' question was: 'Have you ever taken part in a formal self-improvement program such as TM, psychotherapy, etc.?' The 3 'sleep' questions were: 'Do you have regular sleep habits?'; 'On average how many hours a night do you sleep?'; 'Do you usually feel you get enough sleep?'. The 'mental disorder' question was: 'Occasionally our research might require our having some information about various medical problems. Please tick any of the following of which you have had experience in the indicated period' (the 'mental disorder' option was embedded among others such as 'heart trouble' and 'high blood pressure').

Summarising table 6.4, all but one of the 'perceptually defensive' participants (89%) had practised one or more forms of mental discipline such as relaxation or meditation, compared to only 57% of 'perceptually vigilant' participants. Similarly, 67% of defensive participants had undergone a 'formal self-improvement' program (such as psychotherapy), compared to only 14% of vigilant individuals. There were three questions on sleeping patterns: only 67% of defensive participants were regular sleepers compared to 79% of vigilant individuals; the defensive participants estimated they slept an average of 7.2 hours per night, while the vigilant participants slept approximately 7.3 hours per night; and 67% of defensive individuals felt they got enough sleep, compared to 77% of vigilant individuals (excluding one participant who was not sure if he got enough sleep). Finally, from table 6.4, 2 out of 9 defensive participants (22%) specifically reported having experienced a 'mental disorder', compared to 1 out of 14 vigilant participants (7%).

While these findings must be interpreted cautiously due to the small numbers involved, there is a clear and consistent pattern: that those individuals who were identified as 'perceptually defensive' on the prototype indicator being developed in this thesis tended to show more signs of sub-optimal mental health (i.e., they had sought a 'calming' mental discipline, they had taken part in formal self-improvement programs, they had (slight) sleep disturbances, and they reported having experienced 'mental disorder') compared to those individuals who had been identified as 'perceptually vigilant'. This therefore confirms my informal impressions that it seemed in retrospect that some of the 'perceptually defensive' participants were less 'well-adjusted' than the vigilant participants. This may therefore give further support to the potential validity of the 'Pandora's Box' methodology as an indicator of perceptual defensiveness, because, as has been described earlier, defensiveness is often regarded as a maladaptive response to stress. However, because this experiment also found a correlation between neuroticism and defensiveness, table 6.4 may principally be showing the 'true life' manifestations of relatively high neuroticism among perceptually defensive participants. This possibility cannot be discounted at this stage, since the 9 defensive participants whose data was included in table 6.4 scored a mean of 15 (*SD*=6.2) points on the neuroticism measure, compared with a mean of only 7.6 (*SD*=3.8) for the 'perceptually vigilant' participants. Experiment 7 will look again at this question with a larger number of participants.

Despite the fact that there was no overall significant forced choice ESP scoring in this study, a few (non-significant) trends emerged which were consistent with previous research findings: over all participants, calls described as 'impressions' were more accurate than those described as 'guesses'. Scoring was negative on emotional targets, and positive on neutral targets, though a slight calling bias in favour of neutral targets may have contributed to this effect. There was, however, a difference in the scoring of defensive and vigilant participants on emotional and neutral targets that could not be accounted for by calling bias. Of the emotional slides, scoring was negative on the simple targets, and positive on the more complex targets. ESP target familiarity appeared to have no effect on scoring patterns. The novel 'unconscious ESP' measure correlated strongly (r_p=.540, p=.000074, 2-t) with forced choice ESP.

Of the unexpected findings in this study, one - the dearth of vigilant males - invites further comment. The question of sex differences in perceptual defence/vigilance has been raised by other researchers (Brown, 1961; Wagstaff, 1974a, 1974b), who have suggested that males and females may differ in their pattern of responses to subliminal emotional stimuli: males may show a linear increase in threshold as a function of stimulus emotionality (so that they become more perceptually defensive as the stimulus becomes more emotional), whereas females may show a curvilinear, inverted-U function (so that their defensiveness increases to a point, then as stimulus emotionality increases further they become perceptually vigilant and thresholds lower). The research on this is by no means unambiguous, but parapsychologists studying defensiveness and psi should be aware that sex differences may be an important factor. All the Icelandic DMT-ESP studies had male non-psychology students as participants; the 3 US studies did not report the sex of their high school pupil participants; Dutch I had 3 females and 15 males, all first year psychology students; Dutch II also used first year psychology students, but their sex is not reported; and no details are given for the participants in Dutch study III. The ability to generalise from these studies' findings may be weakened if males and females do differ significantly in their strategies for coping with emotional or stressful stimuli.

Without wishing to make any strong claims about the 'objective' subliminality of the stimuli administered via Pandora's Box, it should be pointed out that only one of the 48 participants in this study, when asked at the conclusion of the defensiveness testing session whether anything was seen other than the small illuminated rectangle, reported seeing anything else (she saw 'an area of darkness' on two of the slides but was unable to identify which slides she saw when looking at them later). Most participants were surprised to see that there was information on the slides and expressed doubt that they could possibly be unconsciously perceiving and responding to that information.

Experiment 4 has suggested that Pandora's Box may be a promising method for exploring the relationship between defensiveness/vigilance and ESP performance, but the correlation found was weak (although it was greater than that found for all 16 DMT-ESP studies) and not statistically significant. Perhaps signs of defensiveness/vigilance could be strengthened by further increasing the emotionality of the subliminal stimuli. Also, one might ask individual participants, after the ESP and defensiveness measures have been taken, to rate the emotional stimuli for emotionality so that one could examine ESP scoring for those stimuli that were particularly emotional for participants. This latter measure might be a compromise between the drawbacks associated with pre-rating stimuli so as to select those which participants find particularly emotional, and the drawbacks associated with stimuli selected to be emotional 'on average', whose emotionality is necessarily 'diluted'.

Chapter 7. Experiment 5: Perceptual defence/vigilance before and after the practice of mental techniques reputed to enhance free-response ESP performance.

Experiment 2, described in chapter 5, enabled the comparison of free-response ESP performance with perceptual defence/vigilance before and after training with various mental techniques reputed to enhance free-response ESP performance. This study found a significant correlation between perceptual defence/vigilance and ESP before training, but no correlation after training. With only 7 participants, these results obviously have to be treated with caution, but an opportunity arose to look again at mental training, free-response ESP, and defensiveness. The labour intensive nature of ESP training studies continues to impose practical restrictions on the number of individuals who can participate (even allowing for multiple experimenters), but meta-analytic techniques enable similar small studies to be combined and treated as a single larger study. Therefore, although the conclusions of experiment 2 were only tentative, it is worthwhile to conduct another, similar study.

Folklore, reports from gifted psychics (e.g. White, 1964), some experiments (e.g. Braud, 1975), and surveys of techniques reputed to develop psi (e.g. Mishlove, 1983; Morris, 1977) all show some consensus regarding the type of person, attitude and routine recommended for developing psi. The individual should be confident, mature, and accepting of psi. Relaxation followed by mind clearing and imagery or meditation techniques to facilitate the psi process were often recommended. Experiments attempting to train ESP have, however, had mixed results and as yet there exists no well-replicated technique for training ESP (George & Krippner, 1984; Palmer, 1978, 1982; Schmeidler, 1988). The present study, which I co-designed and conducted with Professor Robert Morris and Dr Deborah Delanoy, explored some mental training techniques, ESP performance, and perceptual defensiveness/vigilance.

Following their involvement in my experiment 4, 14 individuals took part in an intensive psi training study with the Koestler Chair of Parapsychology. This was regarded as a preliminary study, following up on that reported in my experiment 2, which was not intended formally to evaluate the effectiveness of mental training techniques for ESP performance. Therefore there was no 'no training' control group and each participant was free to vary the emphasis they put on the various mental techniques. Naturally, this limits the conclusions which may be drawn from the study as regards the efficacy of particular mental techniques for enhancing ESP, but the study's principal aims were: to identify promising participants for future studies; to see whether any improvement might be seen in ESP performance over the duration of the study, and to gain some informal impressions of which mental training techniques might be most useful to explore in more detail in later experiments.

Like my experiment 2, this experiment provided an ideal opportunity to study pre- and post-training perceptual defensiveness/vigilance and free-response ESP. Since experiment 2, of course, a forced choice and an 'unconscious' ESP method had been designed specifically for use with Pandora's Box, and these measures would also be used in this study.

The data of the participants in Experiment 4 who went on to do the training study were taken to be the 'pre-training' measure of ESP and defensiveness, and following the conclusion of the training participants once again took my measure of defensiveness and conscious and unconscious ESP with emotional and neutral targets.

The training study is described in more detail elsewhere (Delanoy, Morris, & Watt, 1991); this report focuses mainly on those aspects of the study which are most directly relevant to this thesis, namely the relationship between perceptual defensiveness/vigilance and ESP performance.

Method

Participants

Fourteen individuals completed this study (2 others dropped out at a preliminary stage before any free-response psi measures had been taken, and 2 dropped out after 2 and 4 training sessions). All had previously participated in my experiment 4. Participants were selected primarily on the basis of their having the time and motivation to take part and of having a suitable environment in which to practice the exercises they would be given. Each of the three experimenters took on the role of 'trainer' for 4 or 5 individuals, and acted as 'assistant' for another 4 to 6 individuals who were being trained by the other two experimenters. The assistant was present at the start of each session and was responsible for setting out and sending (if requested) the ESP target. The assistant left after giving the participant feedback about the target identity, so that they were not involved in the subsequent mental training component of the session.

Stimuli

Targets for my post-training sessions were identical to those used in Experiment 4, though in a different pseudo-random order for each participant (as before, I remained blind to the ESP target order until each session was completed). Targets for the free-response ESP measures taken during the training study consisted of approximately postcard sized art prints and photographs; the participant and the assistant used duplicate target packs so that there was no possibility of sensory cueing (e.g. 'greasy fingers') as to the actual target identity, and the trainer and the participant were kept blind as to the target identity until this was revealed by the assistant after the judging of each free-response ESP trial.

The selection of targets for the free-response ESP measures was randomly designated by a person not otherwise involved in the study, using a standard random number table (Rand Corporation, 1955). The target designations were kept in a locked box for which the three experimenters had the only keys. The target orders for the forced choice ESP measure, like experiment 4, were constructed using the pseudorandom algorithm of a BBC computer.

Psi measures

The pre-training psi measures were as described in chapter 6 for experiment 4: forced choice conscious ESP and unconscious ESP for 12 emotionally negative and 12 neutral targets. The post-training psi measures were identical to those used for the pre-session, except for one difference: no sender was used for the post-training measures. The training part of the study used three different free-response psi measures: 1. participants practised informally at receiving impressions of targets given to them to work with at home (without a sender); 2. they also recorded their impressions of 'remote' targets that were set out in the office of their experimenter (the experimenter was blind as to the target's identity); 3. there was also one 'in-house' ESP trial conducted when the participant came into the lab for a training session.

To begin with, all participants had a sender for this third 'in-house' ESP measure; later, participants were allowed to choose whether or not to work with a sender. The 'remote' and the 'in-house' ESP measures were conducted under strict security conditions (detailed in Delanoy, Morris, & Watt 1991), but only the in-house measure will be correlated with defensiveness, as the in-house measure is most similar to that used in experiment 2. The forced-choice and unconscious ESP measures that took place in conjunction with the Pandora's Box methodology were also strictly controlled so that neither participant nor experimenter could know the target identity prior to or during the recording of the participant's calls.

Procedure

Overview of procedure. Following the pre-training measure of perceptual defensiveness/vigilance and conscious and unconscious ESP, participants took part in the training study, which consisted of 2 preliminary sessions (P1 & P2), 12 training sessions (T1-T12) and one follow-up session. The post-training measure of perceptual defensiveness/vigilance was administered at the end of T12. During the course of the 12 training sessions, participants were encouraged to spend approximately 30 minutes daily practising various exercises at their homes. The first 14 sessions took place at approximately weekly intervals. The final follow-up session was scheduled to take place 3-4 months after completion of the training study.

Each of the training sessions followed a similar procedure: chat about previous week's mental exercise practice; in house psi exercise; judging of remote psi target; chat about previous week's at home psi practice; introduction to new mental exercise to be practised during the coming week.

An abbreviated description of the contents of the preliminary and training sessions follows:

P1. Participants meet the three experimenters; trainer is assigned; study is described.

P2. Confirm participation and implications thereof; choose or assign assistant; mock-up of in house psi session, including instructions on how to make mentations and how to judge; Myers Briggs Type Indicator is administered (Myers & McCaulley, 1985).

T1. Introduction to relaxation: safe harbour imagery, deep breathing, Jacobson Progressive Relaxation.

T2. Further relaxation: autogenic relaxation and mind clearing techniques. Introduction to interview technique for gaining psi impressions.

T3. Strategies for learning new skills: stress reduction; self-esteem/internal dialogue; attitudes to success and failure; attitudes to psi.

The following 6 sessions formed two groups of three. The order of presentation of each of these groups was counterbalanced between participants, so half of them received the 'focusing of attention' exercises first, and half received the 'imagery' exercises first.

T4. Introduction to simple visual imagery exercises.

T5. More complex imagery trips using multiple senses and sometimes involving ESP target.

T6. Creative use of rich imagery trips, specifically aimed at gaining information about ESP target.

T7. Introduction to simple 'passive' focusing of awareness, using internal physiological process or image as focus.

T8. 'Active' focusing of awareness using same focus as previously and sometimes attempting to keep mind blank.

T9. Introduction to White's (1964) 'Waiting Technique' for gaining ESP impressions.

No more new exercises were introduced after T9. The final three sessions were intended to allow review, refinement and consolidation of those techniques which the participants felt had been most helpful and most successful with regard to gaining ESP impressions.

T10. Review. Handout detailing practical (non-psi) applications of the various exercises participants had been given over the weeks.

T11. Further review.

T12. Debriefing questions.

Following the conclusion of T12, participants then took part in the post-training measure of perceptual defensiveness/vigilance and conscious and unconscious ESP. Whereas in experiment 2, participants did half of the subliminal test before training and half after, in this experiment participants completed the entire subliminal measure both before and after training. Prior to training, there were two sessions on Pandora's Box, (separated by one week), as described previously. After training, both sessions were run together (because participants were already familiar with me and with the procedure, the session took less time than before). The first half of the post-training session consisted of the ESP measure (without an agent this time, and using a different slide order than in the pre-training session); the second half consisted of the measure of perceptual defence/vigilance (using a different slide order from the pre-training sessions). Because I wanted to get some indication of each individual's personal emotional reaction to the emotional ESP target pictures, participants filled out a 7-point rating scale for each of the pictures (before they knew whether or not they had had an ESP 'hit' for that picture). The scale asked them to: 'Please circle a number from 1 to 7 to describe the quality and strength of emotion you associate with each picture.' Scale points ranged from 7 ('Very Strong Unpleasant Emotion') through 4 ('No Emotion') to 1 ('Very Strong Pleasant Emotion').

Hypotheses and exploratory questions

Main hypotheses

The first two hypotheses relate to the training aspect of the study:

H1. Forced choice (conscious) ESP scoring will be more positive on the post-training measure compared to the pre-training measure.

H2. Magnitude of discrimination between E and N slides (the unconscious ESP measure) will be greater on the post-training session compared to the pre-training session.

The following three hypotheses are predicted from the trends that were observed in the ESP scores for experiment 4 (part of which consists the pre-training session in this experiment), and relate specifically to the *post-training* conscious ESP measures:

H3. Conscious ESP scoring will be higher for calls that participants reported were based on 'impressions' than those based on 'guesses'.

H4. Conscious ESP scoring will be higher for the complex emotional targets than for the simple emotional targets.

H5. Conscious ESP scoring will positively correlate with unconscious ESP scoring.

Exploratory Questions

Although experiment 2 did correlate perceptual defensiveness/vigilance with free-response ESP performance before and after training, predictions to the current study cannot confidently be made because there were so few participants in experiment 2 (only 7). It is even less clear what to expect for post-training correlations between defensiveness and conscious and unconscious ESP, since there is no precedent for this situation. The analyses relating to perceptual defence/vigilance and free-response ESP and to post-training correlations between defensiveness and forced choice (conscious) and unconscious ESP will therefore be purely exploratory.

Also for the first time, participants' individual ratings of forced choice ESP target emotionality will be examined, to see whether extremely emotional targets are associated with higher or lower ESP scoring than mildly emotional targets.

Results and discussion

Fourteen individuals participated in this study (10 females, 4 males, mean age 45.2, range 20-66 years). All participants had previously taken part in my experiment 4, and their subliminal perception and ESP data from that experiment forms the 'pre-training' data in this study. Four participants (3 females, 1 male) dropped out of this study at an early stage, two before they had done any free-response ESP sessions, and two after 2 and 4 free-response ESP sessions. It is important to consider whether the loss of these individuals (and, hence, their data) might have selectively biased the findings of this study, and this will be discussed at the appropriate points below.

Change in ESP scoring after training

As there was no 'no training' control group, any improvement in scoring cannot be confidently attributed to the effects of training, but such an improvement would encourage a more rigorous follow-up study into the effects of training. The first two hypotheses related to the training aspect of the study for the forced choice (conscious) ESP and unconscious ESP measures.

Table 7.1 gives the results for ESP performance before and after training. For forced choice ESP, pre-training Z=.549 (based on 172 hits out of 333 trials), and post-training Z=1.693 (p=.0452, 1-t) (based on 184 hits out of 336 trials). A Wilcoxon test of the difference in ESP scoring from pre- to post-training gives W=32 (n.s.). There is therefore some indication of an improvement in forced choice ESP scoring after ESP training, and some support for hypothesis 1, but the magnitude of the effect is not statistically significant.

Table 7.1
ESP performance before and after mental training

	Pre-training	**Post-training**
Forced-choice ESP (Z score)	.549	1.693 (p=.0452, 1-t)
Unconscious ESP (mean brightness score)	.800	.730

Considering the possible impact of not including the forced choice ESP data of the four participants who dropped out of this study, the mean number of forced choice ESP hits for these participants (for the pre-training measure, which was the only one they did) was 13.25. Therefore these participants scored slightly above chance and so had their data been included they would have slightly increased the forced-choice ESP scoring for the pre-training measure.

Unconscious ESP scores, as measured by the magnitude of discrimination between blank slides' brightness scores when E or N ESP slides are simultaneously displayed in another room, were marginally lower on the post-training session, therefore hypothesis 2 was not supported. The combined results for both the pre-training and the post-training forced choice ESP score give Z=1.625, which is marginally statistically significant (p=.052, 1-t).

For free-response ESP (for which no specific hypotheses were made as regards this thesis, though the three experimenters hypothesised an improvement in scoring for the study as a whole), the Z score for sessions T1-6 was .63, while for sessions T7-12, Z=.83. Thus there was a small non-significant improvement in free-response ESP performance over the duration of the study. Considering the possible impact on the above results of the two participants who dropped out of the study after completing 2 and 4 free-response ESP sessions (and whose data were was not included in the above analysis), both of these participants had results exactly at chance level (mean target rank 2.5) so there is no possibility that the loss of their data either selectively increased or decreased the remaining ESP scores.

Based on the trends observed in experiment 4, it was predicted that conscious ESP calls based on 'impressions' would score more highly than 'guesses'; Table 7.2 shows (for the post-training session only, as the pre-training session formed a sub-set of the data of experiment 4) that Z=1.890 (p=.0294, 1-t) for impressions, and Z=0 for guesses. A Wilcoxon test of the difference in scoring for impressions and guesses gives W=50 (n.s.). There is therefore some support for hypothesis 3, but not to a statistically significant extent. It was also predicted from experiment 4 that conscious ESP scoring would be higher for the complex emotional targets than for the simple emotional targets, pehaps due to the greater stimulation and interest associated with more complex material. As is seen in table 7.2, complex targets gave Z=1.213, while simple targets gave Z=0; the difference in scoring for complex and simple targets is not statistically significant (W=20), so there is some support for hypothesis 4, though not to a statistically significant degree. No predictions were made for scoring on emotional and neutral targets, and it was found that scoring was positive for both (Z=1.161 and Z=1.625, respectively), with the highest scoring for the neutral slides.

Table 7.2

Z scores for forced choice ESP performance (on post-training session) for 'impressions', 'guesses', simple and complex emotional targets, and emotional and neutral targets

	Z
'Impressions'	1.890 (p=.0294, 1-t)
'Guesses'	0
Simple E	0
Complex E	1.213
Emotional	1.161
Neutral	1.625

Finally on the ESP scores, it was predicted from experiment 4 that in the post-training session conscious ESP would correlate positively with unconscious ESP. It was found that r_S=-.377; this is a nonsignificant correlation in the direction opposite to that predicted (one would need a correlation of .539 for p<.05, 2-t, for 14 participants), so hypothesis 5 is not supported.

Exploratory questions

Experiment 2 found that fewer participants appeared to be perceptually defensive *after* training to improve relaxation, imagery, and self-esteem than was the case before this training. One might expect this if one accepted the assumption that such training might be expected to reduce characteristic defensive tendencies. Since there were only 7 participants in experiment 2, little credit could be given to this trend. However, the present study found the same trend: out of 14 participants, 7 in the pre-training session had brightness scores for emotional slides ranked 1 or 2 (tending towards defensiveness) (and 7 participants had brightness scores ranked 3 or 4, tending towards vigilance); after training, 4 participants had ranks 1 or 2 for E slides, and 10 participants had ranks 3 or 4 for E slides. There is therefore some support for the trend seen in experiment 2, though again the small numbers in the present study mean that one must be cautious in interpreting this trend.

Considering the possible impact on the defensiveness data of those participants who dropped out of this study at an early stage, two (one male, one female) were perceptually vigilant, one (female) was perceptually defensive, and one (female) was slightly vigilant. It is unlikely that the loss of these participants' defensiveness scores would have significantly altered the pattern that was observed in this study.

No firm predictions were made as regards the post-training correlations between perceptual defence/vigilance and ESP performance and neuroticism, and the pre-training relationship between free response ESP and perceptual defence and vigilance was also uncertain (so these are 2-tailed analyses). Table 7.3 summarises the findings of these analyses. The table shows, firstly, that the correlations between brightness score on emotional *control* slides and the ESP and neuroticism measures are, as one would expect, small and nonsignificant (r_S=-.047 for conscious ESP; r_S=-.021 for unconscious ESP; r_S=.045 for free-response ESP; and r_S=.018 for neuroticism).

Table 7.3
Perceptual defensiveness/vigilance correlated (Spearman's rho*) with ESP performance, before and after training*

	Pre-training r_S		
	Rank E	**Rank EC**	**Notes**
Forced choice ESP (total hits)	.336	-.047	(subset of expt 4's data)
Unconscious ESP	.207	-.021	(subset of expt 4's data)
Free response ESP (T1-6)	.498[1]	.045	
Neuroticism	-.699[2]	.018	(subset of expt 4's data)
	Post-training r_S		
Forced choice ESP (total hits)	-.395	.036	
Unconscious ESP	.513[1]	-.124	
Free-response ESP	-.389	-.227	
Neuroticism	-.512[1]	-.273	

[1] n.s. (for n=14, one would need r_S=.539 for p<.05, 2-t)
[2] (p<.0005, 1-t)

Pre-training measures. Not surprisingly, given that they formed part of experiment 4's data, there were correlations in the predicted direction between perceptual defence/vigilance (responses to emotional slides) and forced choice ESP (r_S=.336), unconscious ESP (r_S=.207) (neither correlation is statistically significant), and neuroticism (r_S=-.699, p<.0005, 1-t). For the first half of the free response ESP trials, however, the nonsignificant correlation of .498 was in the direction opposite to what one might expect (the method of scoring free response trials means that a positive correlation indicates that the defensive participants had higher ESP scores than the vigilant participants.)

Post-training measures. None of these analyses was statistically significant at the two-tailed level (recall that no firm predictions were made for these post-training analyses), but it can be seen that the defensiveness-neuroticism and defensiveness-unconscious ESP correlations continue to be in the predicted direction (r_S=-.512 and r_S=.513, respectively). The defensiveness-forced choice ESP correlation is, however, negative after training (that is, the direction of the correlation is reversed from that found in the pre-training session), giving r_S=-.395. The defensiveness-free response ESP correlation changes direction from the pre-training measure to indicate a slight tendency for vigilant individuals to score more positively than defensive individuals on post-training free-response ESP; r_S=-.389).

Target emotionality and ESP. The final exploratory question related to the ESP slide emotionality ratings that, for the first time, had been collected from each participant in the study. Of the 12 emotional targets, 8 were simple black and white line drawings, and 4 were more colourful and complex pictures and photographs. The mean emotionality rating given to the simple slides by participants in this study was 5.45, while for the complex slides the mean rating was 5.5. The pre-rating that had been completed for these slides by other individuals had given an average emotionality rating of 6.16 for the same slides. (On the rating scale, point 5 was described as 'mild unpleasant emotion', while point 6 was 'fairly strong unpleasant emotion'; the maximum rating of 7 was 'very strong unpleasant emotion').

Thus the 14 participants in this experiment found the slides to be slightly less emotional, on average, than did those 20 individuals who initially rated the slides prior to commencing experiment 1 for this thesis. There could be at least two possible reasons for this: the original raters may have given a slightly more extreme rating to the selected slides because these slides were rated alongside a large number of other slides, many of which were less extremely emotional - so in relative terms the selected stimuli were judged to be more emotional because of their milder context; alternatively, one could argue that, as emotionality ratings in the present study were taken after participants had experienced two ESP testing sessions with these stimuli (so they had looked at them during feedback twice), the participants were more accustomed to the selected stimuli. Also, obviously, simple individual differences in the personality characteristics of the two samples of raters could contribute to the different emotionality ratings.

The reason for gathering individual participants' emotionality ratings was to explore how ESP performance was related to degree of target emotionality. In experiment 4, it was seen that overall participants scored slightly negatively for the emotional targets ($Z=-.836$) and positively for the neutral targets ($Z=1.361$). When the results for the emotional targets were broken down, it was seen that there was fairly strong negative scoring for the simple emotional targets ($Z=-1.686$), and mildly positive scoring for the complex targets (Z=.800). Looking only at the post-training ESP measure for the present study (since the pre-training measure forms a sub-set of experiment 4's data), it was found that participants scored positively for both emotional and neutral targets (Z=1.161 and Z=1.625, respectively), and that scoring was higher for the neutral than for the emotional targets. Thus the present participants' scoring for the emotional targets followed the same trend as in experiment 4 (scoring higher for neutral than emotional targets), but scores were increased all round. And as we have already seen, for the present study scoring for the simple emotional targets was exactly at chance (Z=0), while for complex targets Z=1.213; so again the pattern of ESP scoring for this experiment is higher but follows the same trend as for experiment 4, suggesting that there is some consistency in participants' reactions to the forced choice ESP task (the difference between scoring for simple and complex targets was in the predicted direction, but was not significant on a Wilcoxon test, *W*=20).

The question arises as to whether the higher ESP scores for the complex emotional targets could be due to their increased informational complexity (so that they are more stimulating and interesting to participants as compared to the simple emotional targets), or to their slightly higher emotionality ratings. This was looked at quite simply by selecting the three slides which had the most extreme emotionality ratings (1 simple and 2 complex slides, mean rating 5.92) the three with the most mild emotionality ratings (1 simple and 2 complex slides, mean rating 4.63). So, we have a sub-group of slides that are matched for complexity, but different on emotionality.

Figure 7.1

Stem-and-leaf display showing number of forced choice ESP hits for the sub-group of weak emotional and strong emotional targets

Weak E hits	Strong E hits
	0
1111111111111	11111111111
2222222222222	2222222222222
33	333

Figure 7.1 gives a stem-and-leaf display showing the number of forced choice ESP hits for the selected weak emotional and strong emotional targets. It can be seen that there is very little difference in scoring for the two categories of emotional slides: combining the forced choice ESP scores for both testing sessions, the most emotional slides were successfully guessed 46 times by participants, and the least emotional slides were successfully guessed 45 times. As can be seen from the figure, there are no outliers to distort this picture. Therefore this preliminary exploration suggests that degree of slide emotionality is not related to ESP scoring, and that perhaps the higher scoring for the complex slides could be due to their cognitively stimulating complexity rather than to their emotionality.

Summary and Conclusions

Like experiment 2, this study took the opportunity to compare defensiveness-psi correlations before and after training that was intended to enhance psi performance. This study doubled the number of participants from experiment 2 (from 7 to 14) and included the forced choice and unconscious

ESP measures that had been developed for experiment 4. Like experiment 2, there were some slight nonsignificant indications of improved free-response ESP performance over the duration of the study; and forced choice ESP scores were significantly positive in the post-training measure. Unconscious ESP scores were marginally lower in the post-training measure. Also as in experiment 2, there was a trend for fewer participants to show signs of perceptual defensiveness *after* training in relaxation and self-esteem than before such training. These trends must be treated with caution, since they are based on only two experiments with, respectively, 7 and 14 participants, and since there is no 'no training' control group for comparison purposes; however, the apparent decrease in defensiveness would be what one would expect if one assumed that the mental training exercises might reduce or alter some participants' habitual defensive reactions.

None of the defensiveness-psi correlations was statistically significant (2-tailed), so the picture of how the defensiveness-psi relationship may alter with training is still unclear (experiment 2 found no correlation between free-response ESP and defensiveness after training, but a significant correlation before training; this study found defensiveness to be slightly related with positive free-response ESP scoring before training, and slightly related with negative free-response ESP performance after training). The defensiveness-neuroticism correlation found in experiment 2 (r_S=-.145, n.s.) was found more strongly in experiment 4 (r_S=-.381, p<.01, 2-t, n=48), and in the group of participants from experiment 4 who took part in the present study (r_S=-.699, p<.01, 2-t, n=14, before training; r_S=-.512, n.s. 2-t, after training).

This study has not been able to clarify further the relationship between defensiveness-vigilance and ESP before and after training, due in part to there being a relatively small number of participants (this will always be a problem with labour-intensive training studies of this sort). One can only suggest that, as more such studies are conducted, their results might be cumulated so that a pattern might begin to emerge. It is encouraging to note, however, that the defensiveness-neuroticism correlation continues to appear before training, and to a lesser extent after training.

On the question of ESP target emotionality (as judged by the experimental participants themselves) and psi performance, this study compared the *average* emotionality ratings for all 14 participants on simple and complex ESP targets. It would, of course, have been preferable to look at the correspondence between each *individual* participant's target slide emotionality ratings and psi performance, because individual differences may be obscured when all 14 participants' scores are averaged. However, taking individual emotionality ratings rather than average ratings turned out to be problematic because, as participants rated each slide on an interval scale (with only 3 points on the 'negative emotional' side - points 5, 6, & 7) rather than on a continual scale, it was common for individuals to give several identical ratings to different pictures. It would often be difficult, therefore, to select out individual slides for extreme emotionality ratings; it would also be difficult, given the limited range of rating scale points that participants could use, to counterbalance emotionality and complexity. With averaged scores, however, it was possible to do this, and this analysis suggested that the higher scoring for the complex emotional targets was not related to their degree of emotionality, but rather to their greater visual complexity. This question will be explored again in experiment 7, with a larger number of participants.

In considering any changes in performance from pre- to post-training in this study, it should be noted that there were some changes in participants and in methodology from the pre- to the post-training sessions: 1. on the pre-training measure participants were unfamiliar with both the defensiveness-testing procedure and with the ESP testing procedures, therefore participants may have been more relaxed and comfortable on the post-training measures; 2. the pre-training forced choice and unconscious ESP measures were done with a sender, while a clairvoyance design was used for the post-training measures, therefore participants' mental set, expectations, and the strategies they used to do the ESP tasks may have been different on the post-training session compared to the pre-training session. (The clairvoyance design was used in this experiment because the participants were experienced and comfortable with this psi technique.) These changes, together with the fact that there was no 'no training' control group, mean that any trends in scoring from pre- to post-training may not at this stage solely be attributed to the mental training exercises themselves rather than to any other factors that changed from pre- to post-training. While the relationship between training and perceptual defensiveness/vigilance and ESP will not be studied further in this thesis (as it is not the main object of interest), experiments 2 and 5 have nevertheless shown some suggestive trends that might stand up to further, more rigorous, experimentation.

Chapter 8. Experiment 6: Subjective reports of visual experiences when the response criterion to weak stimuli is relaxed; and a consideration of alternative indicators of defensiveness/vigilance.

Experiments 2, 3, 4, and 5, have mostly shown the predicted correlations between apparent perceptual defence/vigilance and/or psi performance (both ESP and PK) and neuroticism. However the effect remains quite weak, especially for the defensiveness-psi relationship. Evidently there are still some questions to be resolved over the effectiveness and validity of the Pandora's Box methodology. To help resolve some of these issues, part 1 of this chapter will describe an experiment designed to explore participants' subjective visual experiences when an aspect of the subliminal perception methodology used thus far is altered. Part 2 will consider the use of different scoring systems for the subliminal perception measure. The concluding section of the chapter will include an evaluation of the statistical power of the studies conducted in this thesis.

Part 1: Experiment 6

Could signs of defensiveness/vigilance be strengthened (in the hope that this would lead to strengthened defensiveness-psi correlations)? Measures were taken to increase the subliminal stimulus emotionality in experiments 3, 4, and 5 (as compared to experiments 1 and 2) by using those stimuli with the highest emotionality ratings. In studies 1 to 5 an extremely conservative response criterion was used (participants were asked to respond when they became aware of the presence of the stimulus slide, not when they became aware of its (as yet unrecognisable) contents); in these studies, therefore, the stimulus intensity was very weak. It is possible that a second avenue for strengthening the stimulus might be to ask participants to adopt a less stringent response criterion, that is, to allow the slides to brighten further before responding to them, so that the stimulus intensity is stronger.

The reason for the extremely stringent response criterion for the studies reported in this thesis was to make sure there was absolutely no chance of the participant discovering the nature of the subliminal stimulus slides: perceptual defence/vigilance is, by definition, meant to be a non-conscious reaction to anxiety-arousing stimuli; if participants get some idea of the slide nature, that awareness would likely change their attitude to the test, which could, in turn, change their responses to the stimuli. As Gregor's original study had apparently shown perceptual defence using a very stringent response criterion, such a criterion was adopted for my experiments 1 to 5. Given that these studies have not had strong results, it appears worthwhile to conduct a study asking participants what they can tell of the stimulus nature when they are responding less stringently, so that the stimulus slides are physically more intense, more visible. The aim is to see whether the rationale behind choosing a conservative response criterion for the studies so far - that even partial stimulus cues may reveal something of the slide nature and so participants should be asked to adopt a very conservative response criterion so that the nature of the stimuli remain unconscious - was well-founded.

In other words, my previous experiments asked participants to respond to the slides while the slides were still so dim that nothing could apparently be perceived of their contents; the present experiment asks participants to allow the slides to brighten until the participants have first impressions of the stimulus contents. The question is whether, using this latter methodology, participants may receive partial stimulus cues (unidentified lines, shapes, etc.) *without* any risk of participants recognising the slide nature (that the stimuli are pictorial, for instance, or that some of the stimuli are emotional) or even recognising the slide contents (a hanging man, for instance). By asking participants to report their subjective visual experiences to the stimulus slides, this experiment takes on board Price's (1990) comment that details of participants' subjective experiences in subliminal detection tasks are often neglected.

Method

The apparatus (Pandora's Box) and stimuli used in this experiment were identical to those used in the defensiveness testing sessions for experiments 4 and 5, and the 'one testing session' procedure for experiment 5 was used again here. In brief, then, participants did 4 runs of 16 'experimental' slides, preceded at the outset by one demonstration and five practice slides, and with another set of demo. and practice slides at the half-way point. The main change was in the instructions given to the participants on when to respond to each stimulus slide. Instead of being asked to press the response button when they became aware of the light rectangle indicating the presence of the slide, participants were asked to allow the slide to brighten until they got their first impressions of seeing something on the slide. They were asked to press the button at this point, and it was stressed that they were not attempting to recognise the slide contents, simply to indicate when they first became aware of the slide contents. Participants were aware that the aim of the study was to find out what they experienced of the slide's contents at this response criterion, and they were asked to make comments on their subjective visual experiences both while they were responding to the slides, and later when discussing the experiment with me.

Secondly, with a view to strengthening the subliminal stimulus emotionality in the next experiment, participants were asked to rate a number of simple black and white line drawings for emotionality (using the same scale as in my previous experiments). From these ratings, some new emotional stimuli would be selected for inclusion in experiment 7.

There was no attempt to take any ESP measures or any personality data in this study - the sole focus was on the measure of perceptual defence/vigilance and on exploring participants' subjective visual experiences to stimulus slides when these slides were permitted to brighten further than in the previous studies reported in this thesis. If it turned out that participants appeared to perceive very little of the nature of the stimulus slides even though they were allowing the slides to brighten to the point where they could see *something* (lines, shapes), then this more relaxed response criterion might be compared with psi and neuroticism scores in a subsequent study. Another exploratory question would be whether, by asking participants to adopt a more relaxed response criterion, a new source of noise or extraneous variance would be introduced into the data. Standard Deviation scores for the brightness scores of participants in this study would therefore be contrasted with those found with the more stringent response criterion, since higher *SD* scores in the present study would indicate more variable data. Such variation need not of course be extraneous or noisy, since if the new response criterion strengthened signs of perceptual defence or vigilance then one would predict more extreme scoring for the emotional slides compared to the others. To be more specific, then, if *SD* scores are raised for all slide categories, then this would suggest that the new response criterion was introducing a new source of noise into the data; if *SD* scores are relatively high for the *emotional* slides compared to the others, then this would suggest that allowing slides to brighten further might increase signs of perceptual defence or vigilance (in this latter case, the problem would remain of whether such increased variation was due to perceptual factors - that is, fluctuating sensory thresholds - or response factors - that is, hesitation to respond to slides that have been consciously perceived as emotional).

As this was purely an exploratory study, no hypotheses or analyses were *formally* planned in advance, though as already suggested trends in the data would be interpreted; friends and colleagues (a few of whom had experienced pilot versions of the Pandora's Box methodology before) acted as participants, and no details were taken of participants apart from their names, sex, and age.

Results

21 individuals took part in this experiment - 9 females, and 12 males, mean age 29.8, range 18-49 years.

Information pick-up with the new response criterion. One of the questions I had was whether participants would pick up much information about the nature of the slides using a less conservative response criterion. Only 2 participants said they had only the vaguest impressions of the slide contents and they couldn't name what they saw. At the other extreme, one participant recognised and could name the contents of nearly all the slides that were recognisable (i.e. not controls); he had found focusing a problem, and for him the slides were unfocused to begin with and then they suddenly 'snapped' into focus at a stage when they were easily seen.

Most other participants did not find focusing a problem. Most participants said they sometimes could see a solitary figure or figures. This is not surprising because there were several slides with the same basic shape (man standing with briefcase, man hanging, man shooting himself, plus their controls) which could become familiar from repeated exposure (familiar information is more readily recognised). The other slides were reported as just vague shapes. People frequently misidentified slides, suggesting the projective nature of the stimuli (with the response criterion adopted for this study, the visual impressions of the stimuli presumably are more similar to those fragmentary glimpses experienced with the Defence Mechanism Test).

Psychological responses to the new response criterion. Nobody made any comments about the emotional nature of the stimuli. Several people reported that it was difficult to resist the temptation to try to identify the slide contents, even though it had been repeatedly stressed to them that this was not their task. The task was to respond to each slide as soon as something, anything, was seen on the slide; nevertheless, I suspect that some individuals were allowing the slide to brighten further than necessary. I never had this impression using the more strict response criterion in the previous experiments. Short of concocting an elaborate 'cover-story', there seems to be no way round the natural human curiosity which is piqued by using the less stringent response criterion.

Brightness scoring with the new response criterion. In experiment 4 (the one with the largest number of participants, 48, and so presumably the most reliable data of the studies so far) the slides reached brightness step 28 on average, when participants responded to them. In the present study, brightness scores were around 48 (this is around the level at which in my preliminary work with Pandora's Box I felt I began to get impressions of the slide contents; thus, the present study gives some objective confirmation for my subjective impressions).

Standard Deviation of brightness scores with the new response criterion. The amount of variation in people's scoring to the slide categories in experiment 4 was around 2.5 *SD*; for the present study it was around 5 *SD*. So there was a great deal more variability in scoring within individuals in this study compared to experiment 4. However this variability did not seem to be related to slide nature: if the new methodology increased signs of defensiveness or vigilance one would expect higher *SD* scores for the emotional slide category compared to the others, and more participants to show overall brightness scores ranked 1 (='defensive') or 4 (='vigilant') for E slides; neither of these was seen. It appeared that the less conservative response criterion introduced more noise into the data, caused by the temptation to let some slides brighten further, to try to recognise the slides, tempered by recollection (and reminders) of the actual task instructions.

Picture emotionality ratings. In order to select some new, possibly more emotional stimuli, for the next experiment, 18 participants each rated 12 pictures for emotionality. Four of these pictures were newly drawn (a foot stepping on broken glass, fingers being guillotined, a threatening face, and a skull and crossbones), and were intended to be emotional. Other pictures were already in use, so the new could be rated in context with the old. The results showed that of the four most emotional pictures, three were already in use; the new 'foot' picture tied with an old 'stabbing' picture for the top emotionality rating (average rating 6, on a 7 point scale).

Experiment 4 used only 4 emotional slides and showed each slide four times; the aim of this was to reach a compromise between a comfortable session length (for the participant, who could find the subliminal task tiring) and a reliable brightness score for each slide. One might speculate however that, as in real life, repeated exposures to emotional stimuli could lead to a lessening of their impact. One could even ask, like Haraldsson & Houtkooper (1992) when discussing the declining DMT-ESP relationship: 'Could the prevalence of increasingly bloody horror movies explain the decline in the series of ESP-DMT correlations, by lowering the intensity of the perceived threat or lack of identification with the central person which is displayed in the DMT?' (p.1094). Perhaps, because of the daily exposure to genuinely gory and 'real' pictures in the news media, people's sensitivity to emotional pictures has been dulled; if this is so, then one either has to go to extreme lengths to show strongly emotional pictures (e.g. photographs of mutilated babies), or one has to accept 'watered down' defensive and vigilant reactions; for ethical reasons, I prefer the latter. For these reasons, it was decided for the next experiment to revert to the '32 stimuli shown twice each' design used in experiments 1 and 2, though incorporating stronger emotional stimuli than were used in these experiments.

Discussion

This study has resolved the question of whether or not to adopt a less conservative response criterion on the measure of perceptual defence/vigilance. It was seen that this methodological change introduced greater variability in scoring, apparently due to the increased amount of 'conscious cognition' which is introduced by letting slides brighten to the point where something is seen. This variability does not appear to be a sign of increased defensiveness or vigilance to the emotional slides because: 1. the variability in brightness scores was not restricted only to the emotional slides (which would have suggested more extreme scoring for these slides compared to the others) - instead, all slide categories had higher *SD* scores than had been found previously, suggesting a possible source of extraneous variance was affecting all the data; and, 2. there was no tendency for the emotional slides' brightness scores to be ranked 1 (='defensive') or 4 (='vigilant') more often than the other slide categories.

Judging from participants' subjective descriptions of their visual experiences with a more relaxed response criterion, when something is seen on the slide participants do not appear to realise the emotional nature of some of the stimuli, so that aspect of the experiment may remain unconscious to participants. Nevertheless, using the more relaxed response criterion means that strictly speaking one is no longer looking at perceptual defence/vigilance in a subliminal perception paradigm, since participants are seeing something on the slides. Many experiments in subliminal perception do use this looser definition of subliminal (one exception being Dixon's closed loop control method, aspects of which the 'Pandora's Box' method is attempting to emulate), but they take a great deal more time and effort to ascertain each individual's 'threshold' and then present the stimuli at or below this level; my method does not permit this. I would rather be able to continue to regard my work as comparing subliminal to extrasensory perception, and to cut out as many sources of noise as possible by retaining the conservative 'awareness of slide presence' response criterion. By relaxing the subjects' response criterion, however, and asking participants to report their visual experience, one began to see the projective nature of these partially visible stimuli, as participants 'saw' things that were not objectively represented on the slides. Thus, the Pandora's Box methodology with relaxed response criterion probably bears more similarity to the method of the DMT, and one should not therefore rule out the possibility that one would similarly find a 'defensiveness'-psi correlation using the revised methodology; this would be an interesting future experiment, but for the present I will continue to work with the subliminal perception paradigm adopted for this thesis.

Part 2: Alternative scoring methods

The second problem to be addressed in this chapter is that of the method of analysis of the brightness scores in the subliminal perception measure. Until now, a very crude method has been used: mean brightness scores are calculated for each slide category, these are ranked, and individuals are defined as defensive if their responses to Emotional slides are ranked 1 (most bright of all) and vigilant if their responses to Emotional slides are ranked 4 (least bright of all). As individuals vary greatly in their visual sensitivity and their choice of response criterion (there is not a distinct moment at which a light rectangle suddenly becomes visible), these brightness ranks are used for calculating correlation coefficients, rather than the 'raw' brightness scores. When the correlation is calculated for criterion participants, whose brightness ranks for E slides are by definition only 1 or 4, this crude method of scoring could be misleading (that is why such correlations are backed up by *t*-tests in this thesis).

Additionally, a gross ranking obviously contains less information than individual brightness scores. This feature has advantages and disadvantages. The advantage is that, if brightness scores are 'noisy', containing variance due to extraneous factors, this noise is masked with rank scores. The disadvantage, however, is that potential information about degree of defensiveness or vigilance is lost using ranked scores. For both these reasons, the second part of this chapter will explore different methods of scoring participants' responses to subliminal slides, to see how these different methods affect the defensiveness-psi and defensiveness-neuroticism correlations which have been seen so far.

Probably, the most promising avenue for increasing the amount of information in the defensiveness/vigilance scores is to devise a ratio measure which contrasts the scoring for the critical, emotional slides, with that for the other slide categories (emotional control, neutral, and neutral control). The first ratio measure that was explored was E-[(EC+N+NC)/3]; that is, the mean of the scores for the non-critical slides EC, N, & NC, was subtracted from the scores of the critical, E slides. For the data of experiment 4, the largest to date, this measure yielded r_S=.183 for the criterion participants. This was in the right direction, but disappointingly small. Looking more closely at this ratio measure, it was found that the value produced was confounded with the participants' overall level of brightness scoring; thus individuals who responded at a relatively bright level for all slides would have higher ratio scores than those who responded at a relatively dim level for all slides, regardless of whether they appeared to be perceptually defensive or vigilant.

The obvious way round this problem is to take a ratio measure which divides the score for the critical emotional slides by the mean of the other three slide categories: E/[(EC+N+NC)/3]. Thus if a person is perceptually defensive, the ratio measure will be greater than 1, and if they are perceptually vigilant, the ratio measure will be less than 1. For the criterion participants in experiment 4 (those whose overall brightness ranks for E slides were 1 or 4), this revised ratio indicator of defensiveness gave r_S=.247; this is again in the right direction, and is a larger correlation than was found using the original crude rankings (r_S=.192). Originally, correlations were also calculated for responses to emotional control slides, and the prediction was that these correlations would be small and nonsignificant. For a control correlation using a revised ratio indicator of defensiveness, one would probably select those participants whose brightness rankings were highest for the EC slides (control defensive, one might say) and those whose brightness rankings were lowest for the EC slides (control vigilant); so apart from the critical correlation one would also calculate a correlation using these 'control criterion' participants' data, predicting that such a correlation would be small and nonsignificant. Doing this, we get r_S=.027 for experiment 4 (n=22).

These *post hoc* analyses with the revised ratio scoring system were sufficiently encouraging to invite further investigation. The same scoring system was used to calculate ESP-Pandora's Box correlations for experiments 2, 3, and 5. The results are shown in table 8.1.

To summarise the contents of table 8.1, it can be seen that, using the original crude ranking indicator of defensiveness/vigilance, 4 out of 6 defensiveness-psi correlations are in the expected direction, but none is statistically significant; the correlations between control slides and psi are, with one exception, smaller than the critical correlations, as one would hope for. Using

Table 8.1

Summary of defensiveness-psi correlations (Spearman's rho*) for experiments 2 to 5: original indicator of defensiveness/vigilance and revised indicators of defensiveness/vigilance*[1]

	Original r_s		**Revised r_s**	
Study No.	**Rank E**	**Rank EC**	**E/[(EC+N+NC)/3]**	**EC/[(E+N+NC)/3]**
2 (training study: free-response ESP)	.514 (n=7)	-.156 (n=7)	.759 (n=7)	.08 (n=7)
3 (psychokinesis)	.291 (n=24)	-.183 (n=24)	.288 (n=17)	-.262 (n=8)
			.187 (n=24)	-.147 (n=24)
4 (forced choice ESP)	.192 (n=24)	-.069 (n=24)	.247 (n=24)	.027 (n=22)
	.149 (n=48)	-.117 (n=48)	.066 (n=48)	-.048 (n=48)
5 (training study: overall correlations) free-response ESP	-.387 (n=14)	-.339 (n=14)	-.314 (n=14)	-.128 (n=14)
forced choice ESP	-.219 (n=14)	.609 (n=14)	-.302 (n=14)	.734 (n=14)

[1] When 2 values are given in 2 rows, the first row, with lower number of participants, is with the 'criterion' or 'control criterion' participants' data; the second row is the correlation calculated for all participants. For ease of comparison, the sign of the correlations have been adjusted so that a positive correlation for the critical measures indicates a correlation in the expected direction (i.e. more vigilant had relatively high psi scores; more defensive had relatively low psi scores).

the revised ratio measure of defensiveness, 5 out of 7 defensiveness-psi correlations are in the expected direction, though again none is statistically significant. Again, with one exception, the control ratio measures of defensiveness all give smaller correlations with psi than the critical measures.

Given the number of correlations represented in table 8.1, the two statistically significant correlations (for the control conditions in experiment 5, forced choice ESP, r_S=.609 and r_S=.734) may have been significant by chance, and were found with a relatively small number of participants, and so they should not be given much weight.

It does not appear, on the face of it, that much is to be gained from adopting a revised ratio measure of defensiveness. A final question is whether, if one were to select for defensiveness-psi correlations those individuals who had the most extreme ratio scores (that is, those individuals whose responses to E slides were most widely divergent from their responses to the other slide categories), one would find a stronger effect. This was done for the data of experiment 4: the E/[(EC+N+NC)/3] scores of the 12 'most defensive' and the 12 'most vigilant' participants in this experiment were selected. The correlation with forced choice ESP performance was r_S=.184, which is *opposite* to the direction expected, so selecting extreme ratio scores does not appear to strengthen the defensiveness-psi effect.

Summary and Conclusions

The first part of this chapter reported an experiment to investigate methodological changes in the subliminal perception procedure developed for this thesis. It was found that adopting a more relaxed response criterion led to a wider variability in scoring. However, that variability did not appear to be due to the emergence of stronger signs of defensiveness or vigilance compared to previous experiments (i.e. more extreme scoring on the emotional slides compared to the others). Instead, participants' conscious attitude to the task changed, with many reporting a temptation to allow the slides to brighten further because their curiosity was piqued by glimpses of slide contents. For the final experiment in this thesis, therefore, it was decided to continue to use the more conservative response criterion as before.

Participants also rated several new pictures for emotionality. Some of these pictures had higher emotionality ratings than those used previously, and it was decided to include these pictures in the next study, and to show a greater number of stimuli twice each, rather than a smaller number four times each, so that each stimulus might retain its emotional impact more than if it were repeatedly exposed.

The second part of this chapter explored alternative methods of scoring participants' responses for defensiveness/vigilance. A revised ratio measure of defensiveness/vigilance was used on the data of experiments 2 to 5. While the crude ranking measure used previously had the advantage of masking extraneous noise, the ratio measure could potentially reveal more information (i.e., degree of defensiveness/vigilance); conversely, there was a risk that the ratio measure could enable more extraneous noise to be expressed in the defensiveness/vigilance scores. It appeared that this ratio measure was no more revealing of defensiveness/vigilance than the previous crude ranking measure.

For the final study of this thesis, therefore, the ratio measure will be included for interest, but the usual scoring system, with target ranks, will be used for correlations, backed up by significance tests of the difference in scoring (for example, on psi and neuroticism) between the two groups of criterion participants (that is, defensive and vigilant individuals).

A note on statistical power.

It seems that the defensiveness-psi correlation has been very weak so far in this thesis (though it has been quite consistent). Were it not for the additional support of the neuroticism-defensiveness correlation, which has been relatively strong and consistent throughout, one might even put the defensiveness-psi results so far down to luck. One must bear in mind, however, that the overall DMT-ESP correlation calculated in the meta-analysis in chapter 2 of this thesis (based on the 16 studies with a total of 582 participants reported by Haraldsson & Houtkooper, 1992) gave r_S=.16.

Along with the developments in meta-analytic procedures that are becoming established in the behavioural sciences, there is a growing realisation that statistical significance is highly dependent upon the power of one's experiments (e.g. Rosenthal & Rosnow, 1991). Power can be defined as the likelihood that a significant result will be obtained if there is a true effect (in this case, a relationship between psi and defensiveness/vigilance); put another way, power can be seen as the likelihood of committing a type II error. Among other factors, the number of participants in a study, or the number of trials conducted, has a dramatic effect on statistical power (as can be seen by looking up significance tables, where as the number of participants increases the size of the statistic required to be significant decreases).

Jacob Cohen (e.g. 1977) has pioneered the study of statistical power in the behavioural sciences. As early as 1962, he found that typically behavioural scientists carried out their research with a remarkably high risk of committing type II errors. Surveying the power of experiments in the *Journal of Abnormal*

Psychology, Cohen (1962) found that for medium effect sizes, and taking statistical significance to be .05, the odds were better than 50:50 that a type II error would be committed. Depressingly, an updated survey of the same journal by Sedlmeier and Gigerenzer (1989) found that typical statistical power had decreased, so that there was less than a 40% chance of obtaining a significant result if there was a true effect. Sedlmeier and Gigerenzer state: 'only 2 out of 64 experiments mentioned power, and it was never estimated. Nonsignificance was generally interpreted as confirmation of the null hypothesis..., although the median power was as low as .25 in these cases' (p. 309).

Taking these findings to heart, what is the statistical power in the studies reported so far in this thesis? Assuming a defensiveness-psi effect size of .3 (which would be seen as correlations around .3, perhaps an over-optimistic assumption), the analysis of the 24 criterion participants reported for experiment 4 had only .42 power (to detect an effect at $p<.05$, 1-t). For the same effect size and significance level, I would need 68 criterion participants for .81 power, and 52 participants for .71 power. Given that in experiment 4 only half of the total number of participants fell into the 'criterion category', one would have to double the number of participants suggested by the power analyses in order to be fairly confident of detecting the defensiveness-psi effect.

For practical reasons, however, it would be unwise for me to attempt to conduct a study with such a large number of participants. The alternative is to compromise, to conduct a study that is larger than those which have been conducted before, thus increasing statistical power, while acknowledging that statistical power is still relatively low. One might then conduct a small meta-analysis, combining the results of the studies in this thesis which are sufficiently similar, in order to increase the odds of significantly detecting a defensiveness-psi relationship, if one exists. The next chapter reports on this final, larger experiment, and this is followed, in the final chapter, by just such a meta-analysis.

Chapter 9. Experiment 7: A study of perceptual defence/vigilance, implicit and explicit ESP performance, and personality.

One goal of this conceptual replication (meaning this experiment 7 as well as the entire thesis), is to consider whether the novel measure of perceptual defence/vigilance that has been developed could be of equal or even greater utility than the DMT as an instrument for identifying participants likely to score well at ESP. Beyond this, there is the goal of learning more about the relationship between defensiveness, in general, and psi. Experiments 2 to 5, comparing subjective awareness thresholds for subliminally-presented emotional slides with psi performance, have shown some encouraging but usually non-significant correlations in the predicted direction: 'defensive' individuals scored relatively poorly at psi tasks, 'vigilant' individuals scored relatively well. From the standpoint of the validity of the prototype indicator of perceptual defensiveness/vigilance, also, it has been encouraging to have repeatedly found that apparent perceptual defensiveness correlates with the well-established personality factor of neuroticisim.

Shortly before the present study was planned, a paper was published (Stanford, 1990) that seemed highly relevant to my previous experiments, in that it provided a theoretical framework for making comparisons between different sorts of ESP measures and defensiveness measures. The present study will enable some more direct examination of Stanford's ideas, and so some space will now be given to summarising these ideas.

The aim of Stanford's paper was to relate evidence from parapsychology and other sciences to his model of spontaneous psi events. As part of his comprehensive coverage of this topic, Stanford included a consideration of subliminal perception as it relates to extrasensory perception, pointing out some potentially interesting research questions which, he thought, had not yet been tackled.

Implicit and explicit measures of perceptual defence and ESP

Stanford reports a meta-analysis of 6 parapsychological studies that have compared sensitivity to subliminal perception with forced choice ESP scoring (the studies were by Eisenbud, 1965; Rao & Rao, 1982 (4 correlations); and Haight, Morrison, & Kennedy, 1977). These six studies were selected by Stanford because they presented the subliminal stimuli at exposure times from 8 to 10 milliseconds so Stanford judged that these stimuli would be below Cheesman & Merikle's (1986) subjective awareness threshold. These studies also involved only *visual* subliminal stimulation (as is typical of studies comparing subliminal to extrasensory perception), to avoid the introduction of possibly misleading findings from pooling across sensory modalities. Stanford excludes the DMT studies from this meta-analysis because, like me, he does not regard the DMT as a measure of subliminal perception (since at later stages participants can see some, and eventually all, of the stimuli in the DMT).

As an example of the methodology used in the studies selected by Stanford, let us consider one of the experimental series reported by Rao & Rao (1982). 50 subjects were tested individually in a session that randomly mixed subliminal perception and ESP trials. The subject was to guess the nature of

60 slides, 30 of which (the slides testing subliminal perception) depicted pictures of 10 objects (such as an airplane, bird, man) and 30 of which (testing ESP) were blank slides smudged with India ink 'in order to make it difficult for the subject to consciously distinguish them from the picture slides' (Rao & Rao, 1982, p.193). These 60 stimulus slides were numbered from 1 to 60. The slide order was determined for each subject by randomly selecting, one at a time, a number from 1 to 60, thus building up a slide presentation sequence. The same 10 object pictures that were used for the subliminal perception slides were then 'associated' to the 30 blank slides by assigning code numbers to the pictures and randomly selecting one code number at a time and entering it against the blank slides in the previously prepared slide presentation sequence. The subject was told the purpose and the nature of the test, but no reference was made to the ESP aspect of the study; therefore an ESP trial consisted of the subjects guessing the nature of a target slide that they thought depicted one of 10 pictures when in fact the slide was simply smudged with ink. Seated in front of a projector screen, the subject was given a few practice trials with slides that were not from the pool of 10 pictures. The subject was then instructed:

> I will now show you another set of slides each showing a picture of one of the following 10 objects: (1) airplane, (2) bird, (3) book, (4) building, (5) cabinet, (6) child, (7) flower, (8) man, (9) nature scene, (10) watch. Just as before, each of them will be shown to you only for a fraction of a second. Please try to make a guess even if you cannot see the objects clearly. The names of the objects are given above in an alphabetical order. Make yourself familiar with the list. Please write your guess in the response column after every projection. Do not omit any column. (p.195)

The stimuli were presented via a projector fitted with a photographic shutter at the exposure time of 1/100th of a second; this time had been selected on the basis of preliminary trials that had shown that subjects could not at this level distinguish between the smudged and the picture slides and were on average guessing the pictures slides correctly less than 30% of the time. Each slide presentation was preceded by a 'ready' signal. In this series, Rao & Rao found a nonsignificant correlation of r=.15 between subliminal perception and extrasensory perception scores.

Stanford's meta-analysis found an overall correlation (weighted by sample size) of .167 between sensitivity or openness to subliminal perception and ESP performance (z=2.707, p=.0069, 2-t). Stanford's meta-analysis therefore provides empirical support for the impression of many parapsychologists and some subliminal perception researchers (reviewed in chapter 2) that subliminal and extrasensory perception are in many respects closely-related phenomena, especially when it comes to the phenomenological experience of the participants, and the perceptual, cognitive, and motivational distortions to which each kind of information (subliminal and extrasensory) is apparently subject.

It was the founder of experimental parapsychology, J.B. Rhine, who said 'It is here, in the common unconscious functions of both sensorimotor and extrasensorimotor (or psi) character, that parapsychology comes closest to psychology' (Rhine, 1977, p.171). Many others have repeatedly indicated the striking parallels between psi and subliminal perception (e.g. Beloff, 1974; Dixon, 1979; Irwin, 1979; Johnson, 1975; Nash, 1986; Rao & Rao, 1982; Roney-Dougal, 1981, 1986; and Schmeidler, 1986, 1988).

Stanford (1990) is the most recent addition to these ranks: he suggests that the subliminal perception-extrasensory perception correlation fits with the idea that preconscious and extrasensory information may be processed similarly, and one implication of this is that:

> it is possible that the demonstrated positive relationship between ESP-task and subliminal performance is, at least in part, influenced by the subject's deliberate effort to retrieve or obtain information and report it, rather than from characteristics of unconscious processing per se (p.120)

Stanford points out that in the studies he reviews (that exclude the DMT-ESP studies), both the subliminal perception and the extrasensory perception tasks are forced choice tasks - so the participant has to make deliberate or explicit efforts to produce the correct response to the tasks. The same could be said of the DMT-ESP studies, where the ESP tasks are forced choice and the DMT methodology involves the subjects deliberately trying to describe what they saw when the stimulus was exposed. While the DMT is not forced choice in the sense that there is a restricted range of possible answers, it is so in the sense that the participant is asked repeatedly to make a conscious effort to describe their perceptual experiences. Stanford says:

> (This) might explain why tests such as the Defense Mechanism Test...that require subjects to try to retrieve *low-level* visual information correlate quite consistently with ESP tasks that involve deliberate efforts at the conscious retrieval of extrasensory information...Subjects with the ability to retrieve deliberately one type of low-level information (sensory) may also have the ability to retrieve another type (extrasensory) (p.122, my emphasis)

Note that Stanford is not simply saying that the same sorts of cognitive *effort* characterise both DMT and forced choice ESP tasks - effort is a component of many tasks; rather, as my emphasis in the above quote indicates, Stanford is repeating the hypotheses made by many other parapsychologists that the similarity between responses to tests such as the DMT and to psi tests is partly due to the attempts to retrieve weak, 'low-level' visual information.

One implication of Stanford's reasoning is that 'DMT performance might not correlate or might not correlate in the same way or in the same degree with performance on a nonintentional or implicit ESP task' (p.122). The kind of implicit ESP task that Stanford has in mind is one where you look for the cognitive consequences of extrasensory information for the processing of nonpsi information (by analogy with subliminal perception tasks in this paradigm, for instance, the effects of subliminal primes on the subsequent processing of supraliminal words, as shown in speed of reaction to the supraliminal words). This kind of task might compare with what I have called in my previous experiments the 'unconscious ESP' measure: where participants indicate when they become aware of the presence of (blank) stimulus slides while simultaneously emotional or neutral slides are being shown in a nearby room. In this kind of task, participants are not deliberately attempting to describe or react to weak sensory information - by definition, participants are intended to be unaware or unconscious of the influence of the weak information on their responses to a neutral or apparently unrelated task. In the 'unconscious ESP' task devised for this thesis, for instance, participants naturally showed varying degrees of discrimination to the identical blank slides, and this was related to the nature of the concurrently-displayed slides as a novel indicator of ESP. Experiment 4, with the largest number of participants and therefore the greatest statistical power (increasing the chances of significantly detecting an effect if it is real) of the studies reported in this thesis, found a nonsignificant correlation in the expected direction of .269 between this measure of ESP and the subliminal perception indicator of perceptual defence/vigilance, for criterion participants. It will be recalled, however, that participants completed a two-stage ESP task, with the 'unconscious' or implicit measure of ESP just the first step. After participants had registered their awareness of the blank slide, they then proceeded to give a traditional forced choice judgement as to the nature of the ESP target slide - whether it was negatively emotional or neutral. This latter is clearly a task that Stanford would describe as an explicit ESP task, since participants are deliberately attempting to identify the nature of weak impressions (incidentally, experiment 4 found that the 'unconscious ESP' measure correlated .540 [p=.000074, 2-t] with the forced choice or 'conscious' ESP task.)

One could, however, argue over whether the 'unconscious' ESP measure used in the experiments reported until now in this thesis was truly 'unconscious': in order to be as honest as possible to them, participants were informed in advance that their responses to the blank slides might be related to the ESP target slides, even though they were encouraged to focus on achieving the same mental attitude as in the previous, defensiveness testing session, where they were simply attempting to be consistent in their reactions to the slowly brightening stimuli. Thus, unlike, for example, Rao & Rao's (1982) series described earlier, participants were aware of the possible ESP aspect of the study. In my experiment 4, the mean brightness score for the 'unconscious ESP' task was 30.87 (mean SD=2.42). This compares with a mean brightness score of 28.33 for the defensiveness testing session (mean SD=2.54). Thus there was a slight trend for mean brightness scores to be higher (though slightly less variable) in the unconscious ESP testing session (when participants were asked to respond in the same way as they had done in the previous week's defensiveness testing session) than in the defensiveness testing session. Possibly, participants' knowledge that the stimulus slides (presented in Pandora's Box) in the ESP testing session were blank and were presented simultaneously with the ESP target slides (presented in the nonadjoining room) affected participants' attitude to, and therefore their responses to, the blank 'unconscious ESP' slides.

To be more confident that the blank slides *do* constitute an implicit ESP task, it would be preferable (methodologically, if not ethically) to use some 'cover story', so that so far as participants are concerned they are only aware of doing one, forced-choice, ESP task. If this methodological change is made, then, in principle, the ESP measures developed for this thesis could permit an examination of both implicit and explicit responses to a single set of targets.

In contrast with the DMT and with the subliminal perception measures in the studies reviewed by Stanford, Pandora's Box could be described as an implicit measure of perceptual defence, since participants are required only to give a simple motor response to a stimulus which is, to them, neutral and meaningless. In the series described earlier, for instance, Rao & Rao's (1982) participants were trying to identify which of 10 possible pictures was being briefly shown to them, thus this was a forced-choice design with a range of 10 possible answers. On Pandora's Box, the critical stimulus information is apparently being presented at subliminal levels of brightness (since the vast majority of my participants reported no visual impressions of the slide contents) and the dependent measure, level of slide brightness at which participants first report slide awareness, is apparently being responded to without participants' awareness of the actual critical contents of the slide. The cognitive demands of the Pandora's Box task, therefore, are quite different to those in the studies reviewed by Stanford and in the DMT studies.

Because the Pandora's Box methodology can therefore be viewed as an implicit subliminal perception task, following Stanford's reasoning one can make the following prediction:

> Using the Pandora's Box methodology, a greater correlation will be found between perceptual defence/vigilance and performance on the implicit (unconscious) ESP measure than will be found between perceptual defence/vigilance and performance on the explicit (forced choice) ESP measure.

This prediction is based on Stanford's assumption (quoted earlier) that tests like the DMT correlate quite consistently with forced choice ESP tests because both involve *deliberate attempts at the retrieval of low-level information*. While the present experiment will make predictions based on this assumption, it is important to note that it is presently *only* an assumption (though admittedly it is an assumption that has been implicitly shared by many parapsychologists as the reason (or a reason) for the defensiveness-psi correlation). When making differential predictions for performance on conscious subliminal/extrasensory perception tasks versus performance on unconscious subliminal/extrasensory perception tasks, many other factors vary concurrently apart from those of deliberate versus not-deliberate retrieval of low-level information. For instance, the former may involve a semantic component, while the latter may not; the former may involve stress or striving, while the latter may not; personality may interact with task so that, for instance, extraverts prefer the former, goal-oriented task while introverts prefer the latter non-striving task. While nevertheless acknowledging that the situation may be more complex than Stanford suggests, it is practical to restrict our attention to comparing tasks characterised grossly as 'implicit' and 'explicit'. If our predictions (of greater correlations between two implicit and between two explicit measures of subliminal and extrasensory perception than between implicit compared to explicit measures) are fulfilled, then it would be time to begin to consider *why* - what are the critical factors that differentiate implicit from explicit measures?

Looking back to experiment 4, it can be seen that there is *post hoc* support for this prediction: for all 48 participants there was a correlation of .149 between defensiveness and conscious ESP (that is, between an implicit subliminal task and an explicit ESP task), and .257 for unconscious ESP (that is, between an implicit subliminal task and an implicit ESP task). For the 24 criterion participants in experiment 4, as expected, the correlations were slightly increased, to .192 for defensiveness and conscious ESP and .269 for unconscious ESP. Thus, experiment 4 showed a pattern of scoring in accordance with that hypothesised by Stanford: the correlation was stronger for implicit ESP, perhaps because the subliminal perception task was also 'implicit'. Unaware of my work, Stanford states 'such predictions have not been studied, but they seem well worth examination' (Stanford, 1990, p. 122). Because only the second, unconscious ESP correlation was statistically significant ($p<.05$, 1-t, n=48), one must treat these findings with caution. It is necessary to conduct another experiment with greater statistical power in order to see whether this trend is confirmed.

(Incidentally, Stanford notes that free response ESP may represent a task mid-way between explicit and implicit ESP; in this context, it is interesting to note that no clear pattern of free-response ESP-defensiveness correlation has been found either in the experiments in this thesis or with studies using the DMT.)

To complete the examination of the relationship proposed by Stanford, one would need to include a more explicit measure of openness to subliminal perception. Olff (1991), comparing the DMT with paper and pencil measures of defensiveness, found that there were virtually no correlations between the two kinds of measures. She suggested that the DMT may be measuring 'primary defence', while the latter measure 'secondary defence'. On the face of it this sounds similar to Stanford's implicit and explicit subliminal perception ideas. However, in the sense that the DMT requires explicit cognitive effort from participants to report their perceptual experiences, I would agree with Stanford's description of the DMT as an explicit measure (perhaps paper and pencil measures should be regarded as 'tertiary').

Were it possible, the DMT would probably be the ideal measure for comparison with Pandora's Box for the relationship of both to implicit and explicit ESP; one would predict that the DMT-explicit ESP correlation would be stronger than the DMT-implicit ESP correlation, while the converse would apply for the Pandora's Box measure of defensiveness. As was pointed out in chapter 2, however, to administer and score the DMT requires extensive training which I have not had, so regrettably another more convenient ('tertiary') measure of defensiveness must be used. Experiment 4's results with Byrne's Repression-Sensitization questionnaire (Byrne, 1961; Byrne, Barry, & Nelson, 1963) suggested that there might be problems of external validity with this instrument. Perhaps recent developments in the psychology of personality might suggest a possible paper and pencil measure?

In the past few years, there has emerged some consensus among personality psychologists that both natural language personality descriptors and a wide variety of personality questionnaires all point to a five-factor model of personality (e.g. John, 1990; Digman, 1990). These 'Big Five' factors have been variously labelled, but the terms used by the NEO-PI-R, probably the most widely used personality inventory based on the five factor model of personality, are: Neuroticism; Extraversion; Openness; Agreeableness; and Conscientiousness (Costa & McCrae, 1992).

The experiments reported in this thesis suggest that Eysenck's Neuroticism correlates quite consistently with perceptual defensiveness, and Costa & McCrae's Neuroticism has been shown to correlate highly with Eysenck's Neuroticism. The NEO-PI-R manual cites a study examining relations between NEOAC and three sets of measures of defense mechanisms (Costa, Zonderman, & McCrae, 1991). This study found 'N was related to measures of regression, displacement, doubt, and maladaptive action patterns, confirming the association of N with poor coping styles' (Costa & McCrae, 1992); this finding provides some support for the notion that Pandora's Box may be an indicator of perceptual defensiveness, and it also indirectly supports the DMT research cited in chapter 2 that suggests an increased likelihood of accidents among deep sea divers, parachutists, and pilots who have relatively high defensiveness scores.

The NEO-PI-R characterises the broad domain of Openness into 6 facets: Fantasy; Aesthetics; Feelings; Actions; Ideas; Values. On the face of it, Openness on these dimensions might be related to lack of defensiveness. There has been little research on this question so far. The study by Costa, Zonderman & McCrae found that O was positively related to adaptive defences and A was negatively related to image-distorting defenses (or superiority), as measured by the Defense Style Questionnaire. Possibly, adaptive defences would equate with perceptual vigilance?

At the time of planning experiment 7, only the Openness scale was available for my use; so it was decided to include this scale with the readily available scale for Eysenck's E and N as an exploratory personality measure in experiment 7. Although one could not make a strong argument that openness equals perceptual vigilance, the possibility is intriguing and well worth investigation. Therefore, the 'explicit' measure of defensiveness/vigilance in experiment 7 would be Costa & McCrae's Openness.

Following Stanford's line of reasoning, then, one would predict a stronger correlation between Openness and forced choice (or explicit) ESP than between Openness and unconscious (or implicit) ESP; and, conversely, one would predict a stronger correlation between (implicit) perceptual defensiveness (as measured by the 'Pandora's Box' subliminal perception measure) and unconscious ESP, than between perceptual defensiveness and forced choice ESP. Acknowledging that there is some doubt over the relationship between Openness and defensiveness/vigilance, this aspect of the experiment will be purely exploratory. However, given the emergence of the 'Big Five' model of personality and the NEO-PI-R as major influences in contemporary personality psychology, it is certainly worthwhile to explore the relationship between Openness, perceptual defensiveness/vigilance, and ESP performance, as the NEO-PI-R is a questionnaire that parapsychologists may readily use and whose use may encourage links between parapsychology and psychology.

For purposes of replication and later meta-analysis, the design and procedure of the present study will be quite similar to my previous studies, especially experiment 4, which focused on forced choice ESP performance as it related to perceptual defence/vigilance. The main methodological change, as argued for in chapter 8, will be to double the number of different slides used, and halve the number of times each is shown. Also, there are several reasons for adopting a clairvoyance design for the present study: 1. it is more convenient and secure to have no sender; 2. my most impressive ESP results so far have been using a clairvoyance design (albeit with experienced participants); 3. anecdotally, it seemed that having a sender might introduce a possible source of noise in the participant's judgement of whether or not a target was negatively emotional - in some cases the sender found a target bland or even humorous and therefore had difficulty sending it as a negative emotional target, while the participant found it quite disturbing when they later viewed it - a clairvoyance design would remove this possible source of confusion; that is, the sender may also play a direct psychic role in the experiment; 4. in Palmer's reviews of psi scoring and neuroticism, he finds the clearest negative relationship between neuroticism and intentional ESP performance in studies that involve individual testing and a clairvoyance design (Palmer, 1977, 1978, 1982). Stanford (1990) suggests this may be due to an individual participant feeling more responsibility, more ego-involvement, in this sort of design:

> it seems plausible that this kind of situation would be precisely the kind of thing...that would favour neurotic manifestations: a clear focus of reponsibility and attention on the performer. But while these patterns seem reasonably clear for conscious, intentional ESP tasks, information is lacking about nonintentional tasks. (p.151)

Kreitler & Kreitler (1990) point out that 'more theoretically oriented discussions of repression emphasize favorably its status as a major element of a *neurotic* personality style' (p.559), and defensiveness appears to be an important factor in repression (defined by Weinberger et al., 1979, as low anxiety, high defensiveness). Therefore, it would appear that using a clairvoyance design might increase the chances of the experimental situation arousing signs of defensiveness in participants.

To increase the statistical power of the study, data will be gathered from a greater number of participants than before. Experiment 4 showed a stronger defensiveness-psi correlation for those 'criterion' participants whose subjective awareness thresholds for subliminally presented negative emotional slides were either highest (=perceptual defence) or lowest (=perceptual vigilance) compared to the other stimulus categories. It was decided to continue to focus the main defensiveness-psi analysis on criterion participants, and to terminate the experiment when data had been gathered from at least 15 defensive and/or 15 vigilant individuals (i.e. if there were 16 vigilant individuals and only 10 defensive, the study would continue until there were at least 15 defensive, even if the number of vigilant individuals increased further).

Method

Participants. Volunteer participants, who had not previously taken part in one of my studies, were invited to participate. Many of these participants had contacted the parapsychology unit out of their interest in the subject, or had attended talks by staff members of the unit. These individuals had each filled out a Participant Information Form (that included some 'sheep-goat' questions and some questions relevant to mental health) and they were sent a letter describing the nature of the study (though, as usual, not revealing critical details of the design and hypotheses). This letter was followed-up by a phone-call that answered any questions the volunteers might have and that arranged a time for their first session if they wished to participate. Also, because there were not enough participants in the pool of volunteers who had not previously participated in a study with Pandora's Box, those who took part in this study were encouraged to invite any interested friends or family to participate, and new participants were recruited this way. When a new name was passed on to me, I wrote to the potential volunteer enclosing details of the study and a PIF form for completion and return. When the PIF form had been completed then the volunteers were telephoned, any questions answered, and a time for the first session was scheduled. Thus the participants in this study were from a slightly different subject population than in experiments 1 to 6 (some of whom were friends and colleagues, but most of whom were 'self-selected' volunteers); those who were contacted by word of mouth in this study, while open-minded about parapsychology, would probably not have been sufficiently motivated or curious to volunteer for experiments on their own initiative.

Overview of procedure

The procedure was quite similar to that of my previous studies, so only the procedural changes will be emphasised. Perceptual defence/vigilance was tested in session 1, with the procedure modified as already noted (principally, double the number of stimulus slides, each shown only twice, to give 64 exposures in total). Participants were given a questionnaire measure of Eysenck's Neuroticism and Extraversion, and Costa & McCrae's Openness, to complete at home before returning in about a week to do session 2. As before, the ESP session took two measures of ESP: 'implicit' or unconscious ESP and 'explicit' or forced choice ESP. For the former ESP measure, participants were not informed that the measure might reflect ESP performance; they were told that the measure was simply to provide a 'baseline' for comparison with the overall level of brightness scoring recorded in session 1. As an exploratory measure, participants would be timed as they responded to the ESP targets, to see whether successful ESP performance was related to the length of time taken (for instance, it has been suggested that 'spontaneity' is conducive to ESP; this would presumably be reflected in briefer ESP sessions). There would be no sender for the ESP session. After all ESP targets had been responded to, the experimenter and participant viewed the targets, and the participant judged each of the 12 emotional targets on his or her individual emotional reactions to the picture (using the same scale as in previous studies). Only after participants had rated the pictures for emotionality were they informed whether or not they had a 'hit' on that target, so their emotionality impressions would not be influenced by their success with the target. The session then ended. Once all data had been collected and analysed, each participant received a letter detailing the main findings of the study, their personal scores, and how to interpret these (e.g., care was taken to explain that high neuroticism scores were quite 'normal' and not indicative of a need for professional help).

Measure of Perceptual Defence/Vigilance

The apparatus for this experiment was identical to that used in experiments 1 to 6. There were 4 categories of stimuli: 8 'Neutral' slides; 8 'Neutral Control' slides; 8 'Emotional' slides and 8 'Emotional Control' slides. Appendix 6 shows the full set of stimuli used for this experiment. Each slide was shown twice. The 8 E slides had been previously rated for emotionality by the 18 participants in experiment 6, mean rating 5.68, *SD*=0.356. The mean emotionality rating for experiments 1 and 2 had been 5.981 (using 8 E slides shown twice each), and that for experiments 3, 4, & 5 was 6.16 (using 4 E slides shown four times each). Thus according to the ratings of participants in experiment 6, the stimuli for the present study are slightly *less* emotional than in previous studies. This is not because some more emotional stimuli were dropped from the pool for the present study; more likely, it is because the participants in experiment 6 included some friends and colleagues who had previously seen (and presumably were more familiar with) some of the emotional slides; also, experiment 6 did not include an ESP-testing session, so participants in experiment 6 rated the stimuli in a slightly different context than previously.

The defensiveness testing sequence was as follows: 1 demo slide, 5 practice slides, 17 experimental slides, short break, 17 experimental slides, longer break, 17 experimental slides, short break, 17 experimental slides, end. It will be noted that this gives more than 64 experimental slides. This is because of a methodological alteration, whereby the first of each run of experimental slides was actually a meaningless 'dummy' slide (with each of the 4 'dummy' slides being identical). It had been observed in previous experiments that after their breaks participants took a little time to 'settle down' to their usual level of responding: there was a tendency for the first slide after a break to have a higher than average brightness score. Because each participant responded to a unique random slide order, this would not have systematically biased results, but it might introduce some extraneous noise. To remove this potential source of noise, then, the first slide of each run was not counted in the analysis, though participants were not aware of this.

Another methodological alteration was to remove the second set of practice slides at the half-way point; this had been a 'hangover' from the early experiments where defensiveness was tested over two short sessions rather than the one longer session used now, and it was no longer considered to contribute anything to the design.

At the conclusion of the defensiveness testing, participants were asked if they had seen anything on the slides, and then they were shown some of the slides (one each of the emotional, emotional control, neutral, and neutral control slides) and the full rationale for the measure was explained.

ESP testing session

This was very similar to the previous experiments, with a few exceptions that will be noted below. This would be a clairvoyance study, so there was no sender. As most participants would feel more confident of success with a sender than without, some time was taken at the outset of the session to explain to participants the advantages of not having a sender, and the successful results already obtained this way. Also, by way of establishing a symbolic link with the room where the targets were located (a link which would normally be provided by a sender), participants were invited to light a candle in the target room, which would stay lit until the ESP testing was over (some participants remarked afterwards that the candle had been included in their imagery strategies for 'reaching' the target). Earlier it was said that a clairvoyance design was adopted because this might induce more ego-involvement (and possibly more stress) than a telepathy design. However, could having a candle diminish this ego-involvement and stress? It was felt that the candle might help the participant feel more comfortable with no sender, but it was nevertheless felt that participants were conscious that they were solely responsible for their ESP impressions, so ego-involvement and a certain degree of stress remained.

As before, there were 24 ESP targets, in a different pseudorandom order for each participant, and both the experimenter and the participant remained blind as to target order until after the participant's ESP impressions had been recorded. The targets consisted of 12 neutral (identical drawings of a simple rectangle) and 12 emotional (the 8 simple drawings as used in session 1, plus 4 more complex pictures and photographs, the same complex targets as used in experiments 4 and 5).

The participant sat at Pandora's Box. The stimuli to be projected in the box began with 1 demo and 5 practice slides, followed by two sets of 12 identical blank slides, that synchronised with the presentation of the ESP slides in the target room. The layout of the ESP target room and the experimenter and participant's room was as previously described in chapter 6, and as depicted in figure 6.1 in that chapter, with the exception that there was no sender in the ESP target room, and the ESP target room was locked. As before, participants did two ESP measures. The first, 'implicit' or unconscious ESP measure, consisted of participants registering their subjective awareness thresholds for a blank slide while a target slide was being simultaneously projected in the target room. Participants were not aware that this was an ESP measure, having been told that it was merely to provide a 'base-line' of their brightness scores for comparison to the previous week's session. Following their response to each blank slide, participants were directed to think about the ESP target slide displayed in the target room. Participants then stated whether they thought the target was emotional or neutral, and whether they had a feeling/impression about the slide, or whether they were just guessing; this was the 'explicit' forced choice ESP measure.

The session ended with target emotionality ratings, feedback on hits, and further discussion about the session.

Only once the two sessions had been completed did the experimenter look at each participant's subliminal and personality data, thus keeping the experimenter and the participant blind during the ESP test of the participant's other scores.

Predictions

1. Defensiveness-psi relationship. Based on the findings of the previous studies, the main predictions of this study were concerned with the relationship between perceptual defence/vigilance and both implicit and explicit measures of ESP, where it was predicted that perceptual vigilance would tend to be associated with relatively high ESP scores (and that the correlations for the control subliminal slides would be relatively small and statistically nonsignificant). Following on the implications of Stanford's theoretical assumptions, a subsidiary prediction was that the defensiveness/vigilance-ESP correlation would be stronger for the implicit ESP measure than for the explicit measure (since Pandora's Box was regarded as an implicit subliminal perception measure). It was not, however, expected that the difference between these correlations would be statistically significant given the anticipated small effect size and consequent low statistical power of this aspect of the study.

2. Defensiveness-neuroticism relationship. Another main prediction, based on the consistent findings of the previous experiments in this thesis, and based on the assumption, justified earlier, that one would expect neuroticism to correlate with defensiveness, was that the relationship between defensiveness and neuroticism would again be found.

3. Forced choice ESP scoring pattern. As suggested by trends seen in experiment 4, that were confirmed in experiment 5, it was predicted that calls which participants described as 'impressions' would score more highly than 'guesses', and that among the emotional targets, scoring would be higher for the 4 'complex' targets than for the 8 'simple' targets.

Exploratory Analyses

The ratio measure of defensiveness/vigilance would be calculated and correlated with ESP and neuroticism, as suggested in chapter 8. It was not known what to expect for the relationship between Openness and perceptual defence/vigilance and ESP. If Openness was regarded as an 'explicit' measure of perceptual vigilance, following Stanford's rationale, then one would tentatively predict a greater correlation between Openness and forced choice ('explicit') ESP than between Openness and implicit ESP.

As with experiment 4, all participants in this study had previously filled out an extensive 'Participant Information Form', which enabled a 'sheep-goat' score to be calculated, reflecting belief in psi; so this measure would be related to the other personality and ESP measures. The PIF form would also enable some description of the self-reported 'mental health' (as shown in sleeping patterns and reported episodes of mental illness, for instance) of participants identified on the Pandora's Box measure as 'perceptually defensive' and 'perceptually vigilant'. Table 6.4, in chapter 6, demonstrated that perceptually defensive individuals tended to show fewer signs of mental health than perceptually vigilant individuals. This study would enable some further examination of this apparent trend with a greater number of participants.

The relationship between length of time taken for the ESP session and ESP performance would also be explored, as would sex differences in defensiveness/vigilance and ESP performance. Other exploratory questions might be suggested by the data.

Results

Seventy-seven individuals took part in this study, but the data of the last 2 was not included because their sessions were conducted after the requisite number of defensive and vigilant participants had been obtained. Of the 75 participants, 44 were female, 31 male, mean age 37.6, range 16 to 74 years. Of the criterion participants, 15 individuals were defensive (10 males, 5 females), and 28 were vigilant (10 males, 18 females). As expected from my previous findings, the 'sex by defensiveness/vigilance (Rank E)' distribution was statistically significant (χ^2=8.397, 3df, p=.038). Notably, far more individuals had brightness scores for E slides ranked 4 (= perceptually vigilant) than for the other 3 ranks, and of these vigilant individuals, there was an excess of females. The 'excess of vigilant females' pattern echoes that found for the criterion participants in experiment 4: there were 10 defensive participants (3 males, 7 females) and 14 vigilant participants (2 males, 12 females). Taken together, these results suggest that, as discussed in chapter 6, sex differences in defensiveness and vigilance may be an important factor to be taken into consideration in experiments of this nature. One cannot at this stage, however, say whether these results are supportive of the hypothesis (Brown, 1961; Wagstaff, 1974a, 1974b) described in chapter 6 that males and females differ in their defensive response, with males showing a linear increase in threshold with an increase in stimulus emotionality and females showing a curvilinear response, with thresholds increasing at first, and then decreasing as stimulus emotionality increases. Further research on this question of sex differences in characteristic defensive response would need to vary *systematically* the degree of emotionality of stimuli and observe how perceptual thresholds varied concurrently. For the moment, however, one can only say that there appear to be differences in the number of males and females who show perceptual defensiveness and vigilance and that parapsychologists ought to be aware of this apparent population trend when conducting (and later generalising from) studies into defensiveness and psi. As has been discussed earlier, the distribution of perceptually defensive and perceptually vigilant individuals in the population (disregarding sex) is apparently not well-established. I inferred from the emphasis in the literature on the phenomenon of perceptual *defence* (i.e., raised thresholds to emotive stimuli) that perceptual defence was found more frequently than perceptual vigilance. If this is so, then the fact that the present study found almost double the number of vigilant compared to defensive participants goes against the usual population bias. However, my experiment 4 also found an excess of vigilant over defensive individuals (14 vigilant, 10 defensive), so the trend for the present study has been found before in this thesis (the trends for the other experiments in this thesis are not included here because these studies had, at the most, half the number of participants for experiment 4, and so imbalances in the number of defensive or vigilant individuals would be quite likely to occur by chance alone).

The main analyses comparing defensiveness with ESP (Spearman correlation coefficients) are calculated using the data of the 43 'criterion' individuals (that is, the 15 defensive and 28 vigilant participants), though all participants' data is included where appropriate for purposes of comparison. Also where appropriate, the correlations are backed up with *t*-tests of the significance of the difference in scoring between defensive and vigilant individuals.

Perceptual defence/vigilance and ESP

Spearman correlation coefficients were calculated for perceptual defence/vigilance versus ESP; the results are shown in table 9.1. As can be seen from the table, the prediction of a correlation between defensiveness/vigilance and forced choice ESP performance was significantly supported (r_S=.310, p<.025, 1-t, n=43), and a *t*-test of the difference in ESP scoring between defensive and vigilant participants gave t=-2.077 (p=.02, 1-t), thus confirming the finding that perceptually defensive individuals tend to score less highly on forced choice ESP than perceptually vigilant individuals.

As expected, the defensiveness-ESP correlation for *all* participants was lower than for those participants whose brightness scores to the subliminally-presented emotional slides were either highest (=defensive) or lowest (=vigilant), though it was still statistically significant (r_S=.198, p<.05, 1-t). Also as expected, the correlations for the emotional control slides were very small

Table 9.1
Correlations (Spearman's rho*) between perceptual defensiveness/vigilance (rank E, and rank EC for control purposes) and forced choice (explicit) ESP*

	Rank E	Rank EC
Criterion Subjects (n=43)	.310 (p<.025, 1-t)	-.014
All Subjects (n=75)	.198 (p<.05, 1-t)	.048

and nonsignificant. This finding therefore adds weight to the positive but nonsignificant correlations between defensiveness/vigilance and psi that were found in experiments 2, 3, and 4 with smaller numbers of participants (and therefore less power to detect the defensiveness-psi effect, if it is real).

Turning briefly to the ratio measure of defensiveness explored in chapter 8 (E/[(EC+N+NC)/3] for the critical measure, and EC/[(E+N+NC)/3] for the control correlation); for criterion participants the former ratio measure of defensiveness gave r_S=-.164 (a nonsignificant correlation in the direction *opposite* to that expected), and for all participants the correlation was very small (r_S=-.093). For the 42 'control criterion' participants (whose mean brightness scores for emotional control slides were ranked 1 or 4), the ratio correlation was r_S=.006, while for all participants the correlation was r_S=.038. Thus it would appear that the 'ratio' measure of defensiveness continues to be less helpful as an indicator of a defensiveness-psi relationship than the basic ranked mean brightness scores.

Table 9.2
Correlations (Spearman's rho*) between defensiveness/vigilance and implicit ESP performance.*

	Rank E	**Rank EC**
Criterion Subjects (n=43)	.268 (p<.05, 1-t)	-.295
All Subjects (n=75)	.152	-.059

A second prediction was that perceptual defence/vigilance would correlate with implicit or unconscious ESP performance, and the results for this analysis are shown in table 9.2.

As the table shows, there is a significant correlation in the predicted direction between implicit ESP and defensiveness (r_S=.268, p<.05, 1-t), however a t-test of the difference in ESP scoring betwen defensive and vigilant individuals is nonsignificant (t=-.988), thus this correlation should be given less weight. As expected, though, the implicit-ESP-defensiveness correlation for *all* participants is smaller than that for the criterion participants (r_S=.152); it is in the expected direction, but is not statistically significant. For all partcipants the control correlation is, as one would hope, tiny (r_S=-.059), but that for the criterion participants is larger than for the correlation with the critical emotional slides (r_S=-.295). This latter effect was not predicted (though remember that the ranked brightness scores for EC slides are not completely independent of the ranked brightness scores for the E slides), but it is nonsignificant on a two-tailed measure of probability.

Looking for interest at the ratio measures of defensiveness, E/[(EC+N+NC)/3] correlated -.173 with implicit ESP for criterion participants (in the expected direction, but not significantly so), and for all participants the correlation was -.182 (again, nonsignificantly in the expected direction). For the control ratio correlation, r_S=-.022 for the 42 criterion participants, and for all participants *r*s=-.034.

It will be recalled that, based on Stanford's ideas, I predicted implicit ESP to correlate more highly with the (implicit) measure of defensiveness than explicit (forced choice) ESP. In fact this prediction was not confirmed: the defensiveness-forced choice ESP correlations were slightly higher than for the implicit ESP measure.

A second (exploratory) measure that tied in with Stanford's line of reasoning was the questionnaire measure of Openness, which was considered possibly to represent an explicit measure of vigilance. The mean Openness scores was 182 (range 146 to 215; *SD*=15.7). In fact, for criterion participants Openness correlated -.106 with perceptual defensiveness/vigilance (contrary to expectations, the more defensive were the more Open), with the Ideas facet of Openness giving the largest correlation (r_S=-.381, p<.025, 2-t). For all participants, Openness correlated -.126 with perceptual defensiveness/ vigilance, and again Ideas correlated most highly, at r_S=-.262 (p<.05, 2-t). These findings suggest that one cannot meaningfully relate Costa & McCrae's Openness to perceptual defensiveness/vigilance as measured by Pandora's Box. Given this, one would not be confident of finding that (explicit) Openness correlated more highly with (explicit) forced choice ESP than with implicit ESP. Table 9.3 shows the findings of this analysis: while the trend is

Table 9.3
Correlations (Spearman's rho*) between Openness and ESP measures*

	Explicit ESP	**Implicit ESP**
Criterion Subjects' Openness (n=43)	.143	.044
All Subjects' Openness (n=75)	.106	.074

in the direction predicted by Stanford, none of the correlations is statistically significant.

Perceptual defence/vigilance and neuroticism

The mean neuroticism score was 11 (range 1 to 21, *SD*=4.9). An important prediction in this experiment was that, as had been found in my earlier experiments, neuroticism would correlate significantly with perceptual defensiveness/vigilance. Table 9.4 shows the outcome of this analysis: the neuroticism-defensiveness prediction is confirmed, being statistically significant for all participants (r_S=-.252, p<.025, 1-t); the control correlations are lower than the critical correlations, and are not significant on a two-tailed test (two-tailed tests are chosen for the control correlations because no directional prediction is being made for these correlations). A t-test of the difference in neuroticism scores between defensive and vigilant participants gives t=1.999 (p=.03, 1-t), thus confirming the relationship between defensiveness and neuroticism.

Table 9.4
Correlations (Spearman's rho*) between Neuroticism and perceptual defence/vigilance*

	Rank E	**Rank EC**
Criterion Subjects' Neuroticism (n=43)	-.239	.225
All Subjects' Neuroticism (n=75)	-.252 $p<.025$, 1-t	.202 (ns, 2-t)

As the neuroticism-defensiveness correlation is one of the more consistent and important (with respect to the validity of Pandora's Box) findings in this thesis, it is interesting to see how the ratio measure of defensiveness correlates with neuroticism. For criterion participants, the correlation is .082; and for all participants it is significant, in the predicted direction: $r_S=.194$ ($p<.05$, 1-t). The 'control criterion' ratio correlates -.269 with neuroticism (ns, 2-t), and -.254 for all participants ($p<.05$, 2-t). Given the size of the control correlations, these findings suggest that the ranking method of scoring is preferable to the ratio method, so far as demonstrating the defensiveness-neuroticism correlation is concerned.

When participants were asked whether they could see anything on the slides being shown in Pandora's Box, the vast majority reported no other visual impressions. On the few occasions when visual images were reported (usually vague blobs, blotches, shapes), participants were unable to identify them or to relate them to the slides when they were later shown these. It can therefore be considered acceptable to continue to describe the slide presentations as 'subliminal'.

Forced choice ESP results

These results are based on the data of all 75 participants. Predictions were made primarily based on the results of experiment 4, which had the most similar design to the present study.

None of the predicted ESP scoring patterns was found. Overall ESP scoring was slightly negative (Z=-.306). It was predicted that scoring on calls described as 'impressions' would be higher than for 'guesses'; in fact the reverse was the case - for impressions Z=-.575, for guesses Z=.325. It was also predicted that complex emotional targets would be associated with higher ESP scoring than simple emotional targets. This prediction was disconfirmed, with Z=-2.256 for complex targets (*p*=.02, 2-t) (i.e., significant *psi-missing* occurred on the targets that, previously, had been associated with the highest positive psi scoring), and Z=.450 for the simple targets. The one overall trend that was in line with the findings of experiment 4 was that scoring was negative for the emotional targets as a whole (Z=-.901) and positive for the neutral targets (Z=.434). Recall, however, that there was a slight bias against calling the target 'emotional' in experiment 4 (with 550 'emotional' calls and 595 'neutral' calls), so that there was a greater likelihood of higher scoring for the neutral targets by chance alone in that experiment. In the present experiment, there were 879 calls for emotional targets and 921 calls for neutral targets; once again, therefore, there is a calling bias against emotional targets that would contribute to lower scoring on these targets by chance alone.

With the exception of the result for the complex emotional slides, none of these forced choice ESP findings is statistically significant, so it would be unwise to go to greater lengths to try to justify them. To complete the picture of reversal of experiment 4's ESP results, it was found that implicit or unconscious ESP correlated -.117 with explicit or conscious ESP - contrary to the expected direction! (Despite this, both implicit and explicit ESP measures correlated significantly and in the predicted direction with performance on the indicator of perceptual defence/vigilance.)

Table 9.5 gives the breakdown of forced choice ESP results for the criterion participants. Again, none of these Z scores is statistically significant. Four of the trends for this study agreed with those for study 4 (Overall ESP, Impressions, emotional, and neutral targets), and the remaining 3 showed different patterns from study 4 (in which vigilant individuals scored more negatively than defensive individuals for guesses, both scored negatively for simple targets and both scored positively for neutral targets). Note that one would expect about 50% of the scoring patterns to be confirmed by chance alone, so little weight should be given to these findings.

Table 9.5
Explicit (forced choice) ESP scoring (Z scores) for defensive and vigilant participants

	Defensive	**Vigilant**
Overall ESP	-1.530	0.965
'Impressions'	-1.219	0
'Guesses'	-1.170	1.375
Emotional targets	-1.528	-0.164
Neutral targets	-0.509	1.584
Simple targets	-0.642	0.335
Complex targets	-1.692	-0.854

Exploratory Questions

These exploratory analyses were calculated with the data of all 75 participants.

Personality measures. The mean extraversion score was 11.7 (range 2 to 21, SD=4.6). Previous experiments showed few significant correlations between Extraversion and other measures. This continued to be the case: extraversion correlated .050 with forced choice ESP scoring, -.107 with unconscious ESP scoring, -.145 with rank E slides (the critical defensiveness measure), and .198 with rank EC slides (the control defensiveness measure). Extraversion did, however, correlate to a statistically significant degree with Openness (r_S=.334, p<.001, 2-t), and especially with the facets of Feelings (r_S=.464) and Actions (r_S=.471).

Belief in ESP. Some interesting results were found for the sheep-goat measure (of belief in psi) extracted from the Participant Information Form. The mean sheep-goat score was 32.6 (SD=5.524), and scores ranged from 18 to 45 (with high scores indicating 'sheepishness', that is, belief in and experience of psi). There were only tiny correlations for the ESP measures (r_S=.009 for explicit or forced choice ESP; r_S=.061 for implicit ESP). There were slight nonsignificant tendencies for sheep to be more extraverted than goats (r_S=.101) and for sheep to be more neurotic than goats (r_S=.198). As one might expect, sheep were, however, significantly more Open than goats (r_S=.241, p<.05, 2-t), especially on the Ideas facet (r_S=.255, p<.05, 2-t).

Older participants tended to be more believing of psi than the young (r_S=.342, p<.0005, 2-t). This finding is contrary to the conclusion of a recent comprehensive review of the empirical literature on belief in the paranormal (Irwin, 1983), that: 'With the major exception of traditional religious beliefs, most paranormal beliefs appear to be stronger in young adults than in elderly people' (p.7). Perhaps differences in the populations sampled by the studies reviewed by Irwin and the present study might explain this discrepancy: the youngest participants in the present study were schoolchildren recruited at a University Open Day when they visited the Psychology Department to learn more about the topics taught in the department. Perhaps these pupils were more 'science-minded' (and possibly therefore more skeptical of psi) than the older participants (many of whom were employed in creative or artistic endeavours).

Finally, on the forced choice ESP measure, experiment 4 had found that, although they did not score differently on ESP, sheep tended to identify more of their calls as 'impressions' than goats, whereas goats tended to call more 'guesses' than sheep. This study found the same pattern: r_S=.244 (p<.05, 2-t) for the former; and r_S=-.420 (p<.0005, 2-t) for the latter comparison.

Time taken for ESP trials. It will be recalled that one new measure introduced for this study was of the time taken to complete the ESP trials. The shortest time was just over 5 minutes, the longest was just over 23 minutes, but around 10 minutes was average. It was found that time correlated .109 with forced choice ESP scores (so those who took longer scored better), and there was a significant correlation between time taken and unconscious ESP (r_S=.269, p<.002, 2-t; again, those who took longer did better).

This interesting finding suggests that, if speed reflects spontaneity, then in this particular experiment, contrary to parapsychological lore, spontaneity did not appear to facilitate ESP performance. However, speed might relate to other factors as well, that cannot be excluded at this point. For instance, one might expect the more relaxed participant to respond more slowly than a relatively alert or nervous participant. Also, a flippant or bored participant might go through the ESP session more rapidly than one who was seriously trying to do well. 'Longer' does not simply equal 'better' in this study, since time taken also correlated significantly with age (r_S=.279, p<.002, 2-t): there was a tendency for older participants to take longer (and age was negatively correlated with forced choice ESP (r_S=-.105), and positively correlated with implicit or unconscious ESP (r_S=.201, ns). That is, the older participants tended to take longer over their ESP session, and to do better at unconscious ESP, than the young.

Sex differences. Apart from the relatively large number of vigilant females already noted, there were no significant sex differences on the main measures taken in this study (neuroticism, extraversion, openness, belief in ESP, and explicit and implicit ESP performance). For the purposes of comparison with the data reported in experiment 4, however, table 9.6 gives a breakdown of basic forced choice ESP performance for male and female participants.

Table 9.6
Forced choice ESP performance (Z scores) for male and female participants

	Male	**Female**
Overall ESP	0.257	-0.647
'Impressions'	0.264	-0.981
'Guesses'	0	0.389
Emotional	-0.156	-1.002
Neutral	0.571	0.044

In terms of who had the highest scores, all of the trends reported for experiment 4 were reversed in the present study, and as none of these is significant, there will be no further attempt to justify or explain these scores.

Target Emotionality Ratings. It will be recalled that all participants in this study rated the emotional ESP targets on degree of emotionality prior to receiving feedback on ESP performance. Similar data had been gathered from participants in experiment 5 and preliminary measures suggested that there were no signs that degree of target emotionality was related to ESP scoring success (rather, that the higher scoring for the complex targets was associated with their greater visual complexity). This study had a far greater number of participants, though, which enables one to be more confident about any such findings. The mean emotionality rating for all 75 participants and all 12 emotional slides was 5.62; thus on the whole participants in this study found the emotional slides to be slightly more emotional than participants in experiment 5. The simple emotional slides received a mean rating of 5.58 and the mean rating for the complex emotional slides was 5.69; therefore, as in experiment 5, on the whole participants found the complex slides to be slightly more emotional than the simple slides.

To investigate further the question of how degree of emotionality relates to ESP scoring, the number of hits were calculated for the three targets receiving the highest emotionality ratings (2 complex, 1 simple, mean rating 6.11) and the three targets with relatively low emotionality ratings (2 complex, 1 simple, mean rating 5.08). The high emotionality targets had 94 hits, compared with 109 hits for the low emotionality targets. Thus there is a slight trend towards lower scoring for the more emotional targets (controlling for target complexity), but this is not statistically significant (t=1.521, 74df,

p=.133). Experiment 5 also found no significant difference in scoring for selected high and low emotional targets. However, no conclusions may be made at this stage on the advisability of using emotional pictures as ESP targets, since it is possible that in both studies there was insufficient difference in the mean emotionality ratings for the high and low emotional targets for the effects of emotionality to reveal themselves in the data. The nature of the neutral ESP targets in these studies (identical drawings of a rectangle) means that they cannot readily be compared with the emotional targets, because other factors such as informational complexity are not held constant.

Summary and Conclusions

This study had two broad aims: 1. to conduct a conceptual replication of the DMT-ESP studies, to replicate to a statistically significant degree the encouraging signs of a perceptual defence/vigilance-ESP relationship seen in my earlier studies, and to replicate the statistically significant defensiveness-neuroticism relationship that was found in my previous studies; 2. to examine the relationship between implicit and explicit measures of defensiveness and ESP, in the light of Stanford's theoretical ideas.

The increased statistical power of this study was perhaps one factor that enabled the first aim to be met successfully. The significant relationship between apparent perceptual defensiveness/vigilance (as measured by subjective brightness judgements for subliminally-presented emotional slides) and ESP performance thus confirms the relatively consistent but nonsignificant trends seen in my earlier studies to be real rather than chance effects. The significant defensiveness-neuroticism relationship (r_S=-.252,

p<.025, 1-t, n=75), though of a smaller magnitude than in experiment 4 (r_S=-.381, p<.01, 2-t, n=48) also supports the notion that the novel 'Pandora's Box' methodology developed in this thesis has some validity, and that it may be measuring some aspect of coping with stress or anxiety aroused by the subliminally-presented emotional stimuli.

Chapter 6 included some descriptive information on self-reported 'mental health' questions (from the Participant Information Form) (see table 6.4), contrasting 'perceptually defensive' individuals' responses to those of 'perceptually vigilant' individuals. It was found that, for experiment 4, there was a distinct tendency for defensive participants to show fewer signs of mental health than vigilant participants (indicated by the greater use of 'calming' mental disciplines, sleep disturbances, and self-reported 'mental disorder' for the former participants). This trend could indicate the external validity of the Pandora's Box measure of perceptual defence/vigilance; though the trend could also have reflected the higher degrees of neuroticism that were found for the perceptually defensive participants compared to the vigilant participants. Because all participants in the present study also completed a Participant Information Form, it was possible to look again at the relationship between defensiveness/vigilance and mental health; table 9.7 summarises the findings for this study; the findings for study 4 are given in brackets for comparison.

The table shows that this study confirms the trend found in experiment 4: there were fewer signs of mental health in perceptually defensive individuals than in perceptually vigilant individuals. Overall, for both the present study and study 4, this trend was in the expected direction for all 12 comparisons. Comparing this study's figures with those of experiment 4, however, it can be

Table 9.7

A summary of responses to PIF questions related to mental health, for 'perceptually defensive' and 'perceptually vigilant' participants in experiment 7 (details of each question are given below the table); the figures for experiment 4 are given in brackets, for comparison.

	Mental Discipline? (%'yes')	Formal Self-Improvement? (%'yes')	Regular Sleep? (%'yes')	Hours of Sleep (mean)	Enough Sleep? (%'yes')	Mental Disorder? (%'yes')
'Perceptually Defensive'	73 (89)	20 (67)	53 (67)	7.02 (7.2)	47 (67)	7 (22)
'Perceptually Vigilant'	61 (57)	5 (14)	54 (79)	7.24[1] (7.3)	57 (77)	0 (7)

[1] This figure excludes the response of one participant who said he slept around 12 hours with 'a break at 6 hours'; it was not clear how long a break he had.

The 'mental discipline' question was: 'Have you ever practised any form of mental discipline/exercise, e.g. meditation, biofeedback, hypnosis, relaxation exercises?' The 'self-improvement' question was: 'Have you ever taken part in a formal self-improvement program such as TM, psychotherapy, etc?' The 3 'sleep' questions were: 'Do you have regular sleep habits?'; 'On average how many hours a night do you sleep?'; 'Do you usually feel you get enough sleep?'. The 'mental disorder' question was: 'Occasionally our research might require our having some information about various medical problems. Please tick any of the following of which you have had experience in the indicated period' (the 'mental disorder' option was embedded among others such as 'heart trouble' and 'high blood pressure').

seen that overall scores are lower for the present study, suggesting overall higher mental health for the defensive and vigilant participants in this study compared to experiment 4. It has already been noted how the population of participants in this study differed from those in experiment 4, because some of the participants in the present study were friends, family, and colleagues of individuals who had volunteered on their own initiative for experiments. In experiment 4, however, all participants volunteered on their own initiative, based on their curiosity in and experience of psi (the mean sheep-goat score in experiment 4 was 34 (range 22 to 47.5), compared to a mean score of 32.5 (range 18 to 5) for experiment 7; thus the participants in the present study were slightly less 'sheepish' than those in experiment 4). Perhaps the different subject population for this study can account for the overall improved indications of mental health compared to experiment 4.

In chapter 6, it was also noted that defensive participants had considerably higher neuroticism scores than vigilant participants (mean neuroticism scores were 15 (*SD*=6.2) for the former, 7.6 (*SD*=3.8) for the latter group), and that this might at least partially account for the apparently higher mental health of the perceptually vigilant participants, since defensiveness/vigilance had been found to correlate with neuroticism. In the present study, the mean neuroticism score for the defensive participants was 12.1 (*SD*=5.1), while for vigilant participants the mean neuroticism score was 9.1 (*SD*=4.3). Therefore the criterion participants (i.e. those who were identified as perceptually defensive or vigilant on Pandora's Box) in experiment 7 had on the whole more moderate neuroticism scores than did those participants in experiment 4. This may account for the smaller magnitude of the defensiveness-neuroticism correlation in the present study (r_S=-.252, p<.025, 1-t, n=75) compared to experiment 4 (r_S=-.381, p<.01, 2-t). The fact that the defensiveness-neuroticism correlation is nevertheless statistically significant in the present study, and that there still appear to be meaningful differences between 'defensive' and 'vigilant' participants on self-reported measures that may relate to mental health, is an encouraging sign that there is some validity to the prototype indicator being developed in this thesis. This study therefore continues to suggest that Pandora's Box shows some promise as an indicator of perceptual defensiveness/vigilance in its own right, and as a tool for enabling parapsychologists to explore the defensiveness-psi relationship in more detail. At this stage, however, I feel that the evidence of the 'validity' of Pandora's Box as a measure of perceptual defensiveness/vigilance is mostly 'circumstantial'; if this prototype indicator were to be taken seriously by psychologists and parapsychologists, much more time and effort would need to be devoted to systematic testing, for instance to establish population norms, and relationships with other measures of perceptual defence and the major personality dimensions.

The second aim of experiment 7 was to consider more fully the theoretical aspect of the relationship between different, implicit and explicit, measures of defensiveness/vigilance and psi. To this end, this study enabled a preliminary exploration of Stanford's ideas (1990), that 'implicit' measures of ESP and perceptual defensiveness would correlate more highly with each other than with 'explicit' measures, and that, conversely, 'explicit' measures of ESP and defensiveness would correlate more highly with each other than with 'implicit' measures. *Post hoc* examinations of the data of experiment 4 had found some support for these ideas. It was argued that the measure of perceptual defence/vigilance was 'implicit', as was the unconscious ESP measure, and that the forced choice ESP task was 'explicit'. It was also tentatively suggested that the questionnaire measure of Openness was an 'explicit' indicator of perceptual vigilance. Contrary to expectations, in this experiment the implicit measure of defensiveness correlated more highly with the explicit measure of ESP than with the implicit ESP measure. As predicted, however, the possible 'explicit measure of defensiveness' (Openness) did correlate more highly with explicit ESP than with implicit ESP, though none of these latter correlations is statistically significant. These findings, while not conclusive in themselves, suggest that the methodology used in the experiments in this thesis may lend itself to further examination of theoretical questions concerning the relationship between different measures of ESP and defensiveness.

The final chapter of this thesis synthesises, where possible, the main findings of the 7 experiments that have been conducted, and suggests directions for future research.

Chapter 10. Summary, conclusions, and future directions.

The links between defensiveness and psi have been thought by many parapsychologists to reside in the common operation of unconscious processes on weak information. For subliminal perception, the weak information is sensory in origin; for extrasensory perception, by definition, attempts are made to exclude the operation of the known senses in perceiving the target information. Based on a model that psi information enters the organism initially at an unconscious level and then emerges in consciousness, however, individuals' attitudes, personality, and characteristic modes of defensive responding may similarly operate to transform or distort both subliminal and extrasensory perceptions.

Resting on these assumptions, then, the aims of this thesis were: to develop a simple yet effective methodology for measuring perceptual defence/ vigilance; to contribute to the study of the defensiveness-psi relationship by conducting a conceptual replication of the DMT-ESP studies; and to explore the process-related questions of how personality and ESP target nature correlate with psi scoring.

Summary and Main Findings

1. *Defensiveness and psi.*

A meta-analysis and a review of relevant literature (chapter 2) suggested the need for replication of the DMT-ESP studies, but pointed out difficulties with the use of the DMT. A consideration of several existing indicators of perceptual defence/vigilance (chapter 3) concluded that none was ideally suited to the aims of the thesis, so a prototype indicator of perceptual defence/vigilance, named Pandora's Box, was developed (chapter 4). After initial development of this methodology, seven experiments were carried out. These experiments continued to refine the Pandora's Box methodology (chapter 5, experiments 1, 2, & 3), as well as enabling the comparison of apparent perceptual defence/vigilance with four different psi measures: free-response ESP (before and after training with various mental exercises) (chapter 5, experiment 2; chapter 7, experiment 5), forced choice and 'unconscious ESP' (chapter 6, experiment 4; chapter 9, experiment 7), and PK (chapter 5, experiment 3).

While the picture for free-response ESP before and after training was unclear, perceptual defence/vigilance was found to relate in the predicted fashion with PK, unconscious ESP, and most consistently with forced choice ESP. These experiments, therefore, conceptually replicate the findings of the DMT-ESP studies.

Using the same techniques of meta-analysis of correlation coefficients reported in chapter 2, one can combine the defensiveness-ESP results of the two most comparable studies in this thesis, experiments 4 and 7, which were the only two studies to take measures of forced choice (or 'conscious' or explicit) ESP and unconscious (or implicit) ESP. The criterion participants were those who apparently showed the strongest signs of perceptual defence or vigilance, and who would therefore be expected to show stronger defensiveness-psi correlations than other participants. Recall that the forced choice ESP measure was to ask participants to identify the nature of each of

24 target slides (12 emotional, 12 neutral) that were projected in a nearby room; the 'unconscious ESP' measure, which was taken before the forced choice ESP measure, asked participants to indicate the moment when they became aware of a gradually brightening *blank* slide, within the Pandora's Box apparatus, while simultaneously an emotional or a neutral target slide was projected in a nearby room.

The results of this meta-analysis are shown in table 10.1, where a positive correlation for Rank E slides represents a correlation in the predicted direction: that perceptually vigilant individuals scored relatively well at ESP, and perceptually defensive individuals scored relatively poorly at ESP; one would not predict a correlation for the EC slides.

The table compares the defensiveness and ESP scores for all participants and for criterion participants. As expected, the defensiveness-ESP correlations are in the predicted direction and are highest for the criterion participants. It is curious to note that one of the correlations for the Emotional Control slides is also statistically significant; this can partly be explained by the fact that the rank of EC slides is not independent of the rank of E slides (and vice versa), so that a positive correlation for E slides would tend to be reflected in a negative correlation for EC slides. One would, however, expect the Rank EC-defensiveness correlation to be smaller than that for the critical Emotional slides, however, and this is so in every case except for criterion participants' unconscious ESP scores.

Table 10.1
Meta-analysis of the correlation (Spearman's rho*) between perceptual defence/vigilance and forced choice (conscious) ESP and unconscious ESP performance for experiments 4 and 7.*

		r_s	Z	p^1	95%ci from	to
Criterion Participants (n=67)						
Forced choice ESP						
	vs Rank E	.27	2.16	.0152	.02	.48
	Rank EC	-.03	.26	.6016	-.28	.21
Unconscious ESP						
	vs Rank E	.26	2.09	.0184	.01	.47
	Rank EC	-.33	2.69	.0072	-.08	-.52
All Participants (n=123)						
Forced choice ESP						
	vs Rank E	.18	1.96	.0250	.00	.35
	Rank EC	.07	.81	.4186	-.11	.25
Unconscious ESP						
	vs Rank E	.19	2.11	.0173	.01	.36
	Rank EC	-.16	1.80	.0724	.02	-.33

[1] Because the experimental hypotheses for Emotional slides were directional, the p values associated with these slides are one-tailed; there was expected to be no relationship between defensiveness and psi for the Emotional Control slides, so the p values associated with these slides are two-tailed.

2. Individual differences and defensiveness.

The psi and defensiveness measures were also related to personality factors (Neuroticism, Extraversion, 'Repression-Sensitization', and Openness), attitudes (belief in psi), and participants' age and sex. The most consistent finding here was that neuroticism correlated with perceptual defensiveness, as one might expect if defensiveness and neuroticism were both considered to reflect maladaptive responses to stress (as has been suggested by Costa & McCrae, 1992). The neuroticism-defensiveness correlation is important, therefore, because it may provide some indication of the construct validity of the prototype indicator of perceptual defence/vigilance. Although it is encouraging to find a defensiveness-*psi* correlation as predicted, very little is as yet known about psi; neuroticism, on the other hand, is a well-established major personality factor, so to find a defensiveness-neuroticism relationship provides some evidence that the Pandora's Box methodology may be measuring something that is related to neuroticism.

A meta-analysis was conducted to combine the neuroticism-defensiveness data of experiments 4 and 7; the results are presented in table 10.2 (with the sign of the correlations adjusted for ease of comparison with table 10.1, so that a positive correlation between neuroticism and E slides indicates a correlation in the predicted direction (that more defensive individuals would be more neurotic)). As the table shows, neuroticism correlated with perceptual defensiveness to a highly significant degree, and in the predicted direction. The neuroticism measure was also given to the 7 participants in experiment 2, but this data is not included in the table because there was no attempt to differentiate between criterion and other participants in experiment 2. However, if one includes the neuroticism-defensiveness data from experiment 2 (r_S=.145 for E slides, r_S=.154 for EC slides, n=7) in the data for all participants (total n=130), the neuroticism-defensiveness correlation (i.e., for responses to E slides) is unchanged, at r_S=.30, Z=3.38, *p*=.0004 (1-t); the 95% confidence interval drops slightly from that shown in table 10.2 (.12 to .45) to from .12 to .44. For responses to EC slides, the correlation drops slightly from that shown in table 10.2 (r_S=-.22) to r_S=-.20, Z=2.28, *p*=.0228 (2-t), and the 95%ci is, as one would expect, lower as well, from -.03 to -.36. Thus, adding the data of experiment 2 has little effect on the overall neuroticism-defensiveness correlation, and slightly lowers the neuroticism-control slides correlation (as one would expect, since the prediction is for no systematic relationship between responses to the control slides and neuroticism).

In fact, for the studies in this thesis the neuroticism-defensiveness correlation was higher than the ESP-defensiveness correlation. This is perhaps not surprising since presumably neuroticism and defensiveness/vigilance manifest in individuals more reliably than ESP talents. This finding supports the notion that Pandora's Box may indeed be able to measure individuals' characteristic coping reactions to subliminally-exposed stressful or emotionally arousing stimuli. Considerable progress has thus been made towards another major aim of the thesis, to develop a simple indicator of

Table 10.2
Meta-analysis of perceptual defence/vigilance and neuroticism correlations (Spearman's rho*) from experiments 4 and 7.*

	r_s	**Z**	p[1]	**95%ci** from	to
Criterion Participants (n=67)					
Rank E	.42	3.45	.0003	.16	.58
Rank EC	-.19	1.47	.1418	.06	-.41
All Participants (n=123)					
Rank E	.30	3.38	.0004	.12	.45
Rank EC	-.22	2.37	.0176	-.03	-.38

[1] Because the experimental hypotheses for Emotional slides were directional, the p values associated with these slides are one-tailed; there was expected to be no relationship between defensiveness and neuroticism for the Emotional Control slides, so the p values associated with these slides are two-tailed.

perceptual defence/vigilance. Much work still remains to be done on this measure, however, and this will be discussed shortly.

The measures of perceptual defence/vigilance and neuroticism can to some extent be examined for their external validity, by looking at participants' responses to some of the questions on the Participant Information Form which was filled out by all participants in experiments 4 and 7 (also, by all participants in experiment 5, who had previously participated in experiment 4). One section of this form asks some questions aimed at finding out the individual's 'mental adjustment', for want of a better term. Table 6.4 in chapter 6 describes the responses of experiment 4's participants to these questions, and table 9.7 in chapter 9 summarises the responses of experiment 7's participants. It was found that, when comparing the responses of individuals who had been identified as perceptually defensive and perceptually vigilant, defensive participants tended to show fewer signs of mental health than vigilant participants. When compared to vigilant individuals, a higher proportion of defensive individuals: 1. had practised a 'calming' mental discipline such as relaxation or meditation; 2. had participated in a 'formal self-improvement' program such as psychotherapy; 3. showed signs of sleep disturbance; 4. had experienced a 'mental disorder'.

Whether this trend reflects neuroticism or defensiveness is not clear, since the two are presumably not mutually exclusive; both seem to reflect characteristic responses to anxiety or stress. However the trend does lend further support to the notion that the measure of perceptual defence/vigilance has some meaning in 'real life'.

Unexpectedly, the studies in this thesis also found signs that males and females might differ in their reactions to the subliminal emotional stimuli: there appeared to be relatively few vigilant male participants. Chapter 6 noted that some of the earlier subliminal perception literature suggested that males and females could show differing styles of defensive responding. Specifically, it had been suggested that females might show a curvilinear relationship between degree of stimulus emotionality and sensory threshold (so that, with increasing stimulus emotionality, females' sensory thresholds would increase to a point, and then begin to drop in the direction of perceptual vigilance) whereas males might show a linear relationship (increasing thresholds together with increasing stimulus emotionality). The present studies did not allow the kind of systematic manipulation of stimulus emotionality and measurement of thresholds that would be needed to directly address the hypothesised sex difference in defensive responding. For the moment, then, one can simply note that, given these suggestions of possible sex differences in defensiveness/vigilance, one should be cautious about generalising from the results of the DMT-ESP studies, since in these studies the majority of participants were male.

3. Successful ESP performance: targets and call types.

A third major area of interest for this thesis was a process-oriented study of psi performance when different kinds of forced choice ESP targets were used: familiar versus unfamiliar; emotional versus neutral; simple emotional versus complex emotional; and emotionally weak versus emotionally strong. There has been little research into the characteristics of successful ESP targets, but the dimensions of complexity, novelty, and emotionality are generally considered by parapsychologists to be important, so this aspect of the thesis was intended to contribute to answering the question of what makes a good ESP target. Attention was also paid to whether the participant reported an 'impression' of the target, or just a 'guess'. The reason for this manipulation was to see whether participants had any 'insight' of times when they were (correctly) responding to ESP impressions.

With the exception of experiment 5, whose participants were experienced at clairvoyance tasks, overall psi performance was unimpressive in these experiments. Looked at more closely, however, there appeared to be some consistent trends for experiments 4 and 5: calls described as 'impressions' scored more highly than 'guesses', and scoring was higher on complex than on simple emotional targets. These trends were reversed by experiment 7, however, so no conclusions may be drawn at this stage. Familiarity with the target appeared not to be an important factor in these studies, and *degree* of target emotionality, as rated by the participants themselves, did not appear to be related to the likelihood of correctly identifying the target nature. Experiments 4 and 7 both found lower ESP scoring for emotional targets compared to neutral targets, while experiment 5, with experienced participants, found little difference between emotional and neutral targets.

Finally, the relationship between 'implicit' and 'explicit' measures of ESP and perceptual defence/vigilance was studied in experiment 7. It was argued that Pandora's Box was an implicit indicator of perceptual defence/vigilance and, as such, that one would expect to find higher correlations between scores on Pandora's Box and an implicit measure of ESP (that is, an unconscious ESP measure) than with an explicit (e.g. forced choice) ESP measure. *Post hoc*, this pattern of scoring was, indeed, found in experiment 4 but it was not found in experiment 7, which had a higher explicit ESP-defensiveness correlation than the implicit ESP-defensiveness correlation.

Conversely, it was also predicted that an 'explicit' measure of defensiveness would correlate more highly with explicit than with implicit ESP. For experiment 7, a recently developed questionnaire measure of 'Openness' was used as an exploratory 'explicit' measure of defensiveness (acknowledging that the relationship between the personality construct 'Openness' and defensiveness was speculative). In line with theoretical expectations, Openness correlated more highly with explicit than with implicit ESP. However, since none of the latter correlations was statistically significant, and since Openness may not in any case equate with 'lack of defensiveness', no definite conclusions could be drawn at this early stage on the relationship between implicit and explicit ESP and defensiveness measures. Perhaps, in a future study, it would be more fruitful to use as an 'explicit' defensiveness measure one of the established 'paper and pencil' measures of defensiveness that was described in chapter 3.

Despite the partial failure to confirm the *post hoc* pattern seen in experiment 4 (between implicit and explicit measures of defensiveness and ESP), it was felt that the methodology developed in this thesis was well-suited to such an exploration of mode of responding to weak information, whether of 'extrasensory' or 'subliminal' origin.

Future Research Suggestions

Throughout this thesis, suggestions have been made for future research. Questions remaining unanswered include: sex differences in perceptual defence/vigilance; the relationship between implicit and explicit measures of defensiveness/vigilance and psi; the relationship between the DMT and Pandora's Box, including whether the DMT measures high and low defensiveness on a single dimension, and how these relate to perceptual vigilance as defined in the subliminal perception paradigm adopted for this thesis. These are all intriguing questions, but since a major part of this thesis was concerned with the development of a new measure of perceptual defence/vigilance, it seems appropriate to comment particularly on how this aspect of the project should proceed from here.

Right from the outset of these studies, it became evident that any effects of perceptual defence/vigilance to subliminally-presented emotional slides were not visible 'to the naked eye'. There were no overt signs of dramatically different responding to the emotional slides compared to the other kinds of slides that were presented. That there was any effect at all was only revealed through the successfully predicted correlations between the subliminal perception measure, neuroticism, and psi scores. Methodological changes were introduced with the aim of strengthening signs of defensiveness/ vigilance, but with limited success.

The sense one has, from looking at the raw data, and from observing participants' reactions to the test, is that there is great potential for extraneous variability in scoring on Pandora's Box. When actually experiencing the test, you are aware of dealing with a very 'labile' measure: some slides seem to creep up and catch you unawares; others seem to take ages to appear; attention can wander, and fatigue or boredom can dull your responses; the stimulus slides gradually emerge rather than suddenly becoming visible, so you are aware of some subjectivity in adopting a criterion for responding to the slides and in attempting to apply this criterion consistently.

One important way of dealing with such potential for variability is to increase the number of responses that participants are asked to make. In these studies, participants responded to only 64 subliminal 'experimental' slides. With four slide categories, that makes only 16 responses per category. It was hoped that this would be sufficient to allow signs of defensiveness/vigilance to appear, as they apparently did to some extent, but all along it has been acknowledged that this is a relatively small number of trials for a possibly noisy measure. Given the limited resources of time and money associated with a project such as this, it was not possible to extend the defensiveness testing over two, or more, longer sessions. Future studies of the Pandora's Box measure should, however, attempt to increase the number of trials completed.

Another, related, question to be considered in the future is the role of the Neutral and Neutral Control slides. These helped to spread out the possible range of the ranks of averaged brightness scores for the four slide categories, but except for the ratio measure of defensiveness, which did not appear to be informative, N and NC scores did not form part of the critical defensiveness measure. Dropping N and NC scores would enable one to double the number of exposures to E and EC slides, while still maintaining the task at a convenient and not too tiring length. Pilot research would be necessary, however, to explore alternative scoring systems if N and NC slides were no longer involved.

Concerning the EC slides, which depicted incoherent lines and whose role was to control for the physical characteristics of the matched E slides, responses to these slides showed virtually no correlation with the main, forced choice, ESP measure. This was as predicted. However, the novel unconscious ESP measure, especially, correlated with responses to the EC slides, significantly so for the criterion participants in experiments 4 and 7.

How might this come about? Looking at participants' scoring patterns, there did not seem to be any systematic relationship between participants' responses to E and EC slides (responding quickly to E and slowly to EC, or responding quickly to both, for instance) that might account for the occasional relatively strong EC correlations. It has already been pointed out that the ranked scoring system used in this thesis means that the ranks allocated to one slide category are not independent of the others. Therefore if, say, a strong positive correlation is found for E slides, one would be quite likely to find a negative correlation for EC slides. One would, however, expect the correlation for E slides to be greater than for EC slides if the 'defensiveness' effect resides, as expected, with the Emotional slides, and this is usually the case. At the present, then, one cannot ascertain whether the control slide correlations with some of the main measures in this thesis may be attributed to chance, to artefact, or to some other as yet unidentified factor. This question should be explored in more detail in further research, but the size and consistency of the effect that is seen for the Emotional slides in relation to the other main measures of ESP and neuroticism, and in contrast to the generally smaller and inconsistent effect for the Emotional Control slides, testifies against the argument that the real effect lies with the EC slides so that the E correlations are artefactual.

Another important question that was not addressed by the studies in this thesis, due again to time and money constraints, was that of the test-retest reliability of the novel measure of perceptual defence/vigilance. The development of any new psychological test is a huge exercise. Done well, hundreds if not thousands of participants should take the measure to establish population norms. The new test should be exhaustively compared to other possibly related tests, and the stability of scoring from one sitting to another should be known. Although experiments 2 and 5 administered the measure of perceptual defence/vigilance twice, in each case participants intensively practised various mental techniques in the interim, techniques such as relaxation which could conceivably affect an individual's defensive reactions. Taken together with the small number of participants in experiments 2 and 5, it was considered that any formal test-retest statistics would be invalid and unhelpful.

Related to these considerations of the development and the validity of the prototype indicator of perceptual defence/vigilance is the question of the *process* underlying the apparent perceptual defence/vigilance effect. It has already been pointed out that perceptual defence and vigilance within the subliminal perception paradigm is defined in physiological terms as differential fluctuations in sensory thresholds for emotional versus neutral stimuli. Little attempt has been made within the subliminal perception literature to integrate this conceptualisation of defensiveness with that seen with the psychoanalytic tradition, where drives and motivations are felt to underlie the defence mechanisms. It is not clear whether the two traditions are merely setting a single phenomenon within different theoretical contexts, or whether they are considering the phenomenon at different levels of description, or whether perceptual defence is something distinct from 'Freudian' defensiveness.

It has already been noted that, regardless of how they conceptualise defensiveness, parapsychologists have found defensiveness to associate quite consistently with relatively poor psi performance. This would suggest that perceptual defence is closely identified with 'psychodynamic' defence (even though the former is defined more narrowly than the latter), or (and not necessarily mutually exclusive of the first interpretation) that the two notions of defence relate similarly to a third, commonly shared, factor (for instance, characteristic reactions to stress or anxiety). One way to begin to untangle these issues would be to take measures of physiological arousal while participants respond to different tests of defensiveness. Specifically for the Pandora's Box measure, therefore, one would note fluctuations in participants' physiological arousal while they are performing the slide-presence task, to see whether there was any systematic relationship between physiological arousal and apparent threshold changes for emotional slides. If there was *no* relationship between physiological arousal and apparent threshold changes for emotional slides, then this would argue against the importance of a physiological model for explaining perceptual defence and vigilance. However, if there *was* a systematic arousal-perceptual defensiveness relationship then this would still not distinguish between the respective contributions of the psychodynamic and physiological models (assuming that the two need not be mutually exclusive), since unconscious motivations and conflicts would be expected to be associated with changes in physiological arousal. If one could find a way of demonstrating the operation of defence mechanisms using a test (such as the DMT) based on psychodynamic assumptions, without finding any concurrent signs of systematic fluctuations in physiological arousal, then this would suggest that sensory or perceptual effects are neither necessary or sufficient to account for apparent perceptual distortions to emotive stimuli. This would be a challenging future project, however, since the most sensitive and labile indicators of physiological arousal, such as the galvanic skin response, are by nature very noisy measures so that any underlying physiological effect could easily be swamped by other influences, much as a sensitive EEG record can be influenced by simple eye-blinks or other body movements.

Conclusion

In sum, the most that can confidently be said about the Pandora's Box technique developed in this thesis is that, as a prototype instrument, it has shown promise as an indicator of perceptual defence/vigilance and therefore as a tool to facilitate the study of the defensiveness-psi relationship, and as a predictor of psi performance on related tasks. Defensiveness was found to relate to questionnaire measures of neuroticism (with the more defensive being more neurotic), and of mental health (with the more defensive showing fewer signs of mental health).

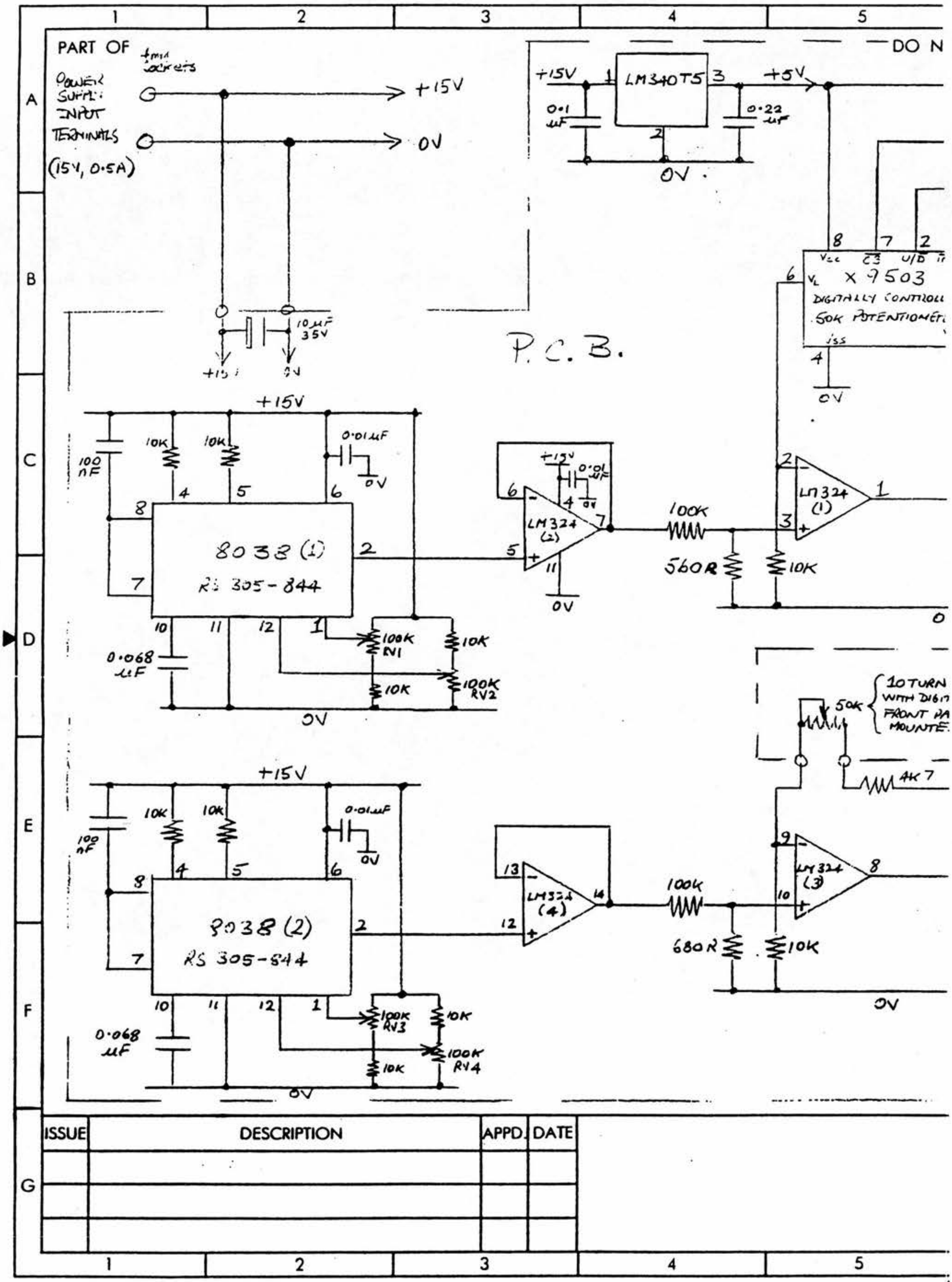
It is acknowledged that far more work must be done before Pandora's Box can seriously be considered as an alternative or a complement to the DMT. Nevertheless, the correlation between perceptual defence/vigilance and forced choice ESP (r_S=.27 for the 67 criterion participants in experiments 4 and 7, p=.0152, 1-t) seen in the studies conducted for this thesis compares favourably with that for the 16 DMT-ESP studies (r_S=.16, n=582, p=.00014, 2-t). This could be regarded as a successful conceptual replication of the

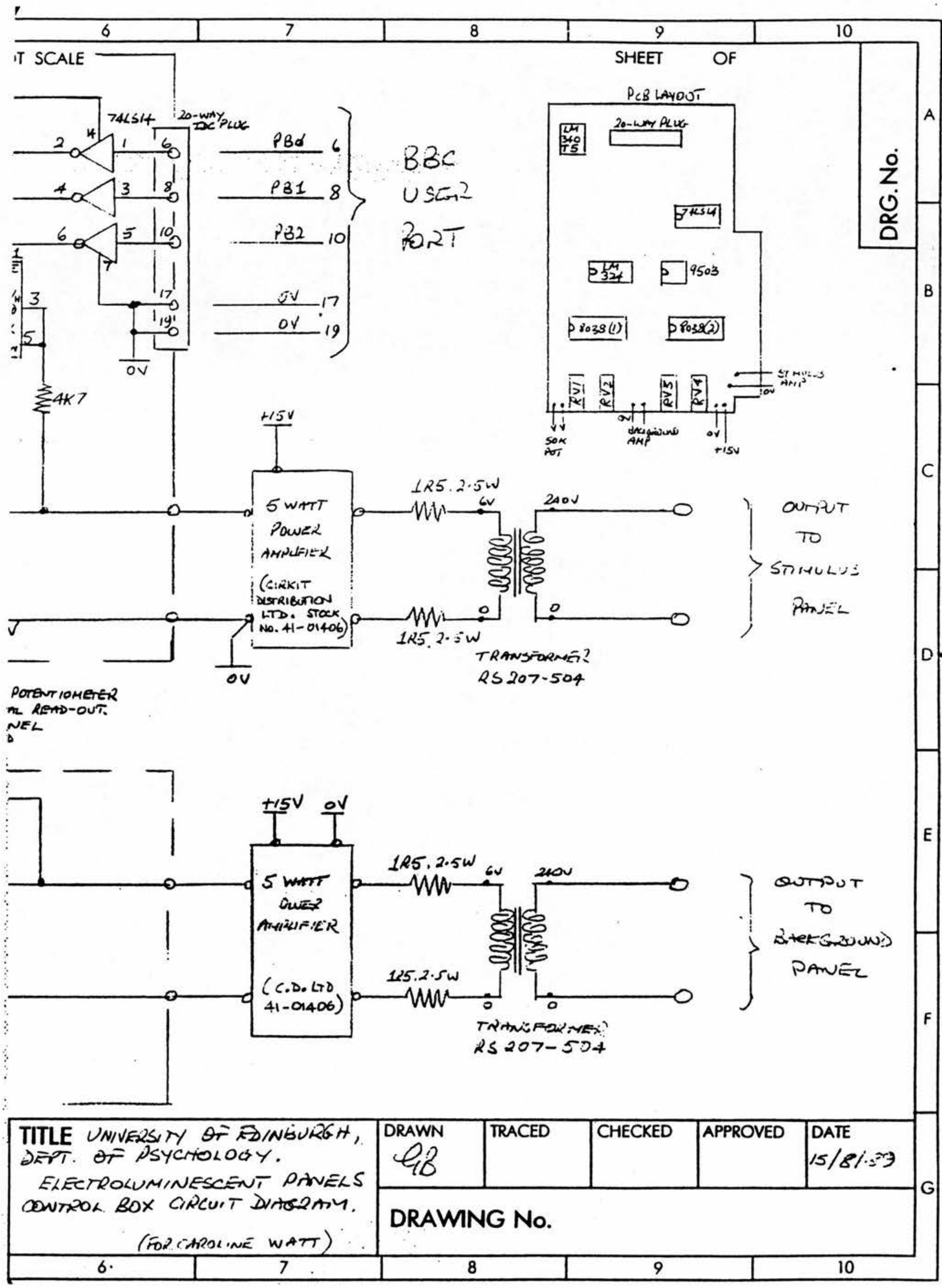
DMT-ESP studies, using a methodology that may be easier than the DMT methodology for others to attempt to replicate.

In a series of 10 DMT-ESP studies, no correlations were found between overall DMT scores and Eysenck's Neuroticism, Extraversion, and Psychoticism (Haraldsson & Houtkooper, 1992), while Cooper & Kline (1986) did not find the predicted relationship between the Repression scale of the DMT and Wallace & Worthington's (1970) measure of perceptual defence. The measure of perceptual defence/vigilance developed in this thesis did, however, show a consistent and sizeable correlation with Eysenck's Neuroticism (r_S=.42, for the 67 criterion participants in experiments 4 and 7, p=.0003, 1-t). As perceptual defence could be considered as one possible manifestation of a neurotic personality style (Costa & McCrae, 1992; Costa, Zonderman, & McCrae, 1991; McCrae & Costa, 1986; Kreitler & Kreitler, 1990; Weinberger et al., 1979), this finding adds validity to the prototype methodology reported here.

With further, more systematic development, then, the Pandora's Box methodology may come to be a useful tool for parapsychologists and psychologists alike. Its potential application ranges widely: the selection of individuals likely to score well at ESP; the detailed examination of process-related questions including the best target-personality-methodology combinations for successful ESP scoring; the possible practical use in occupational psychology (like the DMT) as a selection measure to identify those individuals best suited to rapidly identifying possibly stressful or threatening information; and, perhaps most usefully, to facilitate the exploration of ways that individuals might recognise and change their habitual defensive responses for the better. These goals are still a long way down the road, but this thesis has taken a step in the right direction.

Appendix 1. Electroluminescent panels control box circuit diagram.




6
7
8
9
10
T SCALE
SHEET OF
A
B
C
D
E
F
G
DRG. No.
74LS14
20-WAY IDC PLUG
PB0 6
PB1 8
PB2 10
0V 17
0V 19
BBC USER PORT
0V
4K7
+15V
5 WATT POWER AMPLIFIER (CIRKIT DISTRIBUTION LTD. STOCK No. 41-01406)
1R5. 2·5W
6V
240V
0
OUTPUT TO STIMULUS PANEL
TRANSFORMER RS 207-504
POTENTIOMETER
READ-OUT.
NEL
+15V
0V
5 WATT OWER AMPLIFIER (C.D. LTD 41-01406)
OUTPUT TO BACKGROUND PANEL
TRANSFORMER RS 207-504
PCB LAYOUT
20-WAY PLUG
LM 340 T5
74LS14
LM 324
9503
8038(1)
8038(2)
RV1
RV2
RV3
RV4
50K POT
BACKGROUND AMP
STIMULUS AMP
0V
+15V
TITLE UNIVERSITY OF EDINBURGH, DEPT. OF PSYCHOLOGY. ELECTROLUMINESCENT PANELS CONTROL BOX CIRCUIT DIAGRAM. (FOR CAROLINE WATT)
DRAWN
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APPROVED
DATE
15/8/.89
DRAWING No.

Appendix 2.Technical data on potentiometer used for measuring electroluminescent panels' light output.

Issued July 1987 **8098**

RS Data Library

Digitally controlled potentiometer ic's X9103, X9503 and X9104

Stock numbers 636-182, 636-198 and 636-205

Three non-volatile potentiometers with maximum resistance values of 10kΩ, 50kΩ and 100kΩ. Packaged in compact 8-pin dil packages, ideal for use in digitally controlled resistance trimming applications.

Each device contains a resistor array composed of 99 resistive elements. Between each element and at either end are tap points accessible to the wiper element. The position of the wiper element on the array is controlled by the $\overline{CS}$, U/$\overline{D}$, and $\overline{INC}$ inputs. The position of the wiper can be stored in nonvolatile memory and is recalled upon a subsequent power-up.

Resolution is equal to the maximum resistance value divided by 99. As an example; for the X9503 (50k ohms) each tap point represents 505 ohms.

Absolute maximum ratings

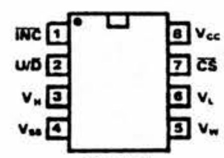
Temperature under bias ______ –65°C to +135°C
Storage temperature ______ –65°C to +150°C
Voltage on $\overline{CS}$, $\overline{INC}$, U/$\overline{D}$ and V_{CC}
referenced to ground ______ –1.0V to +7.0V
Voltage on V_H and V_L
referenced to ground ______ –8.0V to +8.0V
Lead temperature (soldering, 10 seconds) ______ +300°C
Wiper current ______ ±1mA

Stresses above those listed under 'Absolute maximum ratings' may cause permanent damage to the device. This is a stress rating only and the functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Features

- Sold state reliability
- Single chip MOS implementation
- Three wire TTL control
- Operates from standard 5V supply
- Wide analogue voltage range ±5V min
- 99 resistive elements temperature compensated ±20% end to end resistance range
- 100 wiper tap points
  Wiper position digitally controlled
  Wiper position stored in nonvolatile memory then automatically recalled on power-up
- 100 year wiper position retention
- Compact 8-pin package.

Pin connections



TOP VIEW

dc operating characteristics T_A = 0°C to +70°C, V_{CC} = +5V ±10%, unless otherwise specified

Parameter	Symbol	Test Conditions	Limits Min.	Type.(2)	Max.	Units
Active supply current	I_{CC}	$\overline{CS} \leq V_{IL}$		25	35	mA
Input leakage current	I_{LI}	V_{IN} = 0V to 5.5V, $\overline{INC}$, U/$\overline{D}$, $\overline{CS}$			±10	µA
Input high voltage	I_{IH}		2.0		V_{CC} +1.0	V
Input low voltage	V_{IL}		–1.0		0.8	V
Wiper resistance	R_W	±1mA		40	100	ohms
V_H voltage	V_{VH}		–5.0		+5.0	V
V_L voltage	V_{VL}		–5.0		+5.0	V
$\overline{CS}$, $\overline{INC}$, U/$\overline{D}$, input capacitance	C_{IN}(3)				10	pF

Notes. (1) 1 LSB = R_{TOT}/99.
(2) Typical values are for T_A = 25°C and nominal supply voltage.
(3) This parameter is periodically sampled and not 100% tested.

Analogue characteristics

Electrical characteristics

End to end resistance tolerance ______ ±20%

Power rating at 25°C ______ 10mW

Wiper current ______ ± 1mA max

Resolution

Resistance ______ 1%

Linearity

Relative linearity ______ ±0.2 LSB[1]

Absolute linearity ______ ± 1.0 LSB

Typical wiper resistance ______ 40 ohms at 1mA

Temperature coefficient

0°C to +70°C ______ ±300ppm/°C typical

Wiper adjustability

Unlimited wiper adjustment
(volatile mode while chip is selected)

Nonvolatile storage of wiper position
10,000 cycles typical

Environmental characteristics

Temperature range

Operating ______ 0°C to +70°C

Storage ______ -65°C to +150°C

ac characteristics T_A = 0°C to +70°C, V_{CC} = +5V ± 10%, unless otherwise specified

Parameter	Symbol	Limits Min.	Typ.[1]	Max.	Units
$\overline{CS}$ to $\overline{INC}$ setup	t_{CI}	100			ns
$\overline{INC}$ high to $U/\overline{D}$ change	t_{ID}	100			ns
$U/\overline{D}$ to $\overline{INC}$ setup	t_{DI}	2.9			µs
$\overline{INC}$ low period	t_{IL}	1			µs
$\overline{INC}$ high period	t_{IH}	3			µs
$\overline{INC}$ inactive to $\overline{CS}$ inactive	t_{IC}	1			µs
$\overline{CS}$ deselect time	t_{CPH}	20			ms
$\overline{INC}$ to V_W change	t_{IW}		100	500	µs

Note. (1) Typical values are for T_A = 25°C and nominal supply voltage.

ac conditions of test

Input pulse levels	0 to 3.0 volts
Input rise and fall times	10 nsec
Input	1.5 volts

Mode selection

$\overline{CS}$	$\overline{INC}$	$U/\overline{D}$	Mode	Power
L	↓	H	Wiper up	Active
L	↓	L	Wiper down	Active
↑	H	X	Store wiper position	Active

Figure 1 ac timing

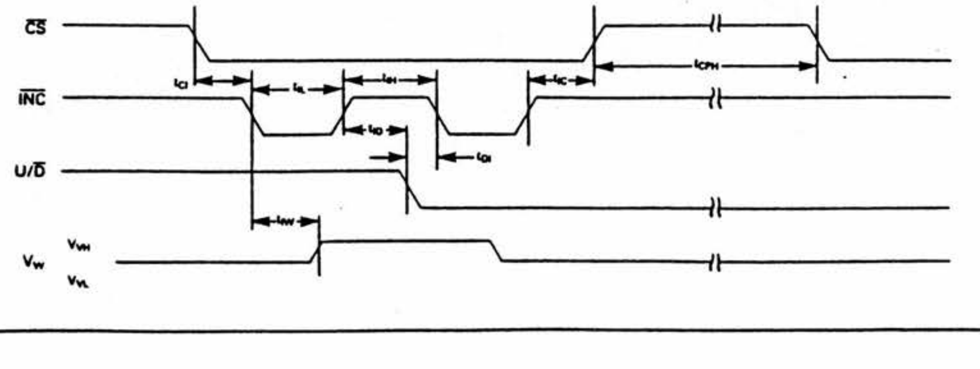
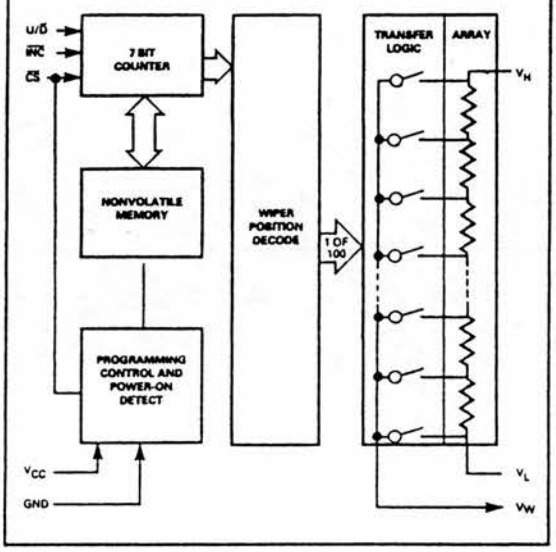


Figure 2 Functional diagram



Pin descriptions

V_H	High terminal of pot
V_W	Wiper terminal of pot
V_L	Low terminal of pot
V_{SS}	Ground
V_{CC}	System power
$U/\overline{D}$	Up/Down control
$\overline{INC}$	Wiper movement control
$\overline{CS}$	Chip select for wiper movement

V_H

The high terminal of the digitally controlled potentiometer is capable of handling an input voltage from −5 to +5 volts.

V_L

The low terminal input is limited from −5 to +5 volts.

The wiper terminal series resistance is typically less than 40 ohms. The value of the wiper is controlled by the use of $U/\overline{D}$ and $\overline{INC}$.

Up/Down ($U/\overline{D}$)

The $U/\overline{D}$ input controls the direction of the wiper movement and the value of the nonvolatile counter.

Increment ($\overline{INC}$)

The $\overline{INC}$ input is negative-edge triggered. Toggling $\overline{INC}$ will move the wiper and either increment or decrement the counter in the direction indicated by the logic level on the $U/\overline{D}$ input.

Chip select ($\overline{CS}$)

The device is selected when the $\overline{CS}$ input is LOW. The current counter value is stored in nonvolatile memory when $\overline{CS}$ is returned HIGH.

Device operation

The $\overline{INC}$, $U/\overline{D}$ and $\overline{CS}$ inputs control the movement of the wiper along the resistor array. HIGH to LOW transitions on $\overline{INC}$, with $\overline{CS}$ LOW, increment ($U/\overline{D}$ = HIGH) or decrement ($U/\overline{D}$ = LOW) an internal counter. The output of the counter is decoded to position the wiper. When $\overline{CS}$ is brought HIGH the counter value is automatically stored in the non-volatile memory. Upon power-up the nonvolatile memory contents are restored to the counter.

The state of $U/\overline{D}$ may be changed while $\overline{CS}$ remains LOW, allowing a gross then fine adjustment during system calibration.

If V_{CC} is removed while $\overline{CS}$ is LOW the contents of the nonvolatile memory may be lost.

The end to end resistance of the array will fluctuate once V_{CC} is removed.

Applications

The combination of a digital interface and nonvolatile memory in a silicon based trimmer pot provides many application opportunities that could not be addressed by either mechanical potentiometers or digital to analogue circuits. The digitally controlled potentiometer addresses and solves many issues that are of concern to designers of a wide range of equipment.

Consider the possibilities:

Automated assembly line calibratrion versus mechanical tweaking of potentiometers.

Protection against drift due to vibration or contamination.

Eliminate precise alignment of PWB mounted potentiometers with case access holes.

Eliminate unsightly access holes on otherwise aesthetically pleasing enclosures.

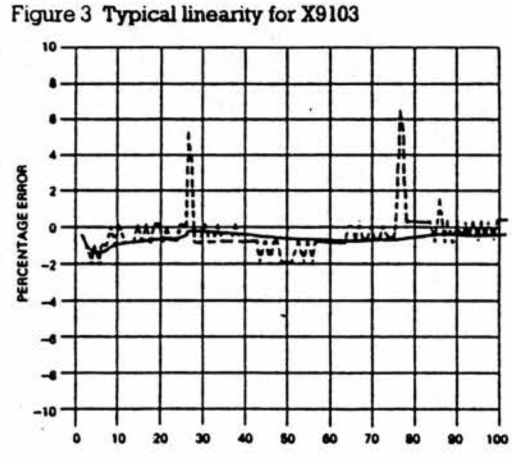
Product enhancements such as keyboard adjustment of volume or brightness control.

Front panel microprocessor controlled calibration of test instruments.

Remote location calibration via radio, modem or LAN link.

Calibration of hard to reach instruments in confined spaces.

Figure 3 **Typical linearity for X9103**



Test conditions

V_{CC} = 5.00V

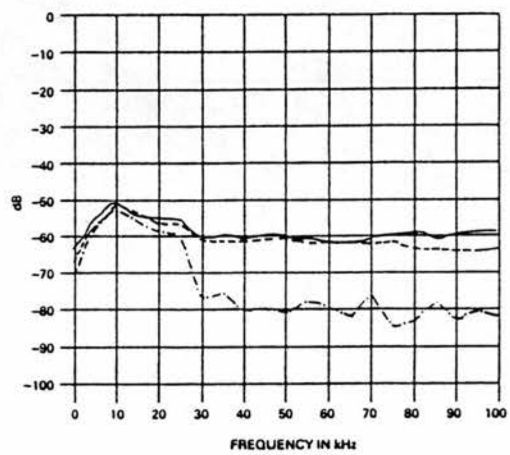
Temperature = Room

Key: ——— = Absolute

.... = Relative

RS Data Library

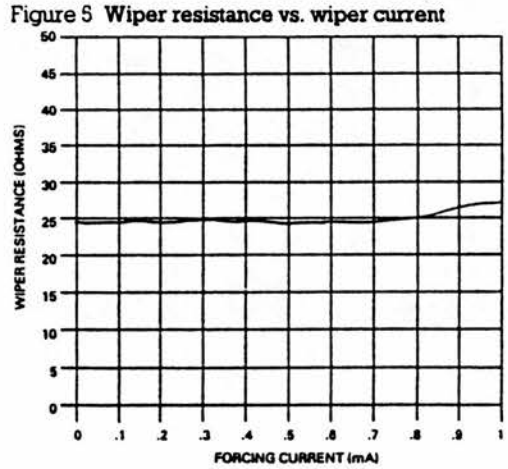
Figure 4 Typical frequency response for X9103



Test conditions
V_{CC} = 4.50V
Temperature = Room
Wiper @ Tap 50
Ampl. = 2Vrms
Test Circuit #1

Key: ———— = 1st harmonic
- - - - - = 2nd harmonic
—·—·— = 3rd harmonic

Figure 5 Wiper resistance vs. wiper current



Test conditions
V_{CC} = 5.00V
Temperature = Room
Wiper @ Tap 50
Wiper resistance
Test Circuit #2

Figure 6 Test circuit #1

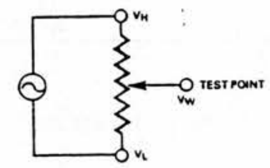
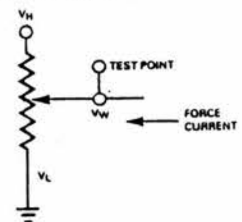


Figure 7 Test circuit #2



Appendix 3.Technical data on amplifier used in control circuit for electroluminescent panels.

5 WATT AUDIO AMP

This kit features a very compact audio amplifier suitable for use as an output stage for a wide range of equipment. The size of the amp should enable it to be incorporated into existing cases or to be constructed as a stand alone unit.

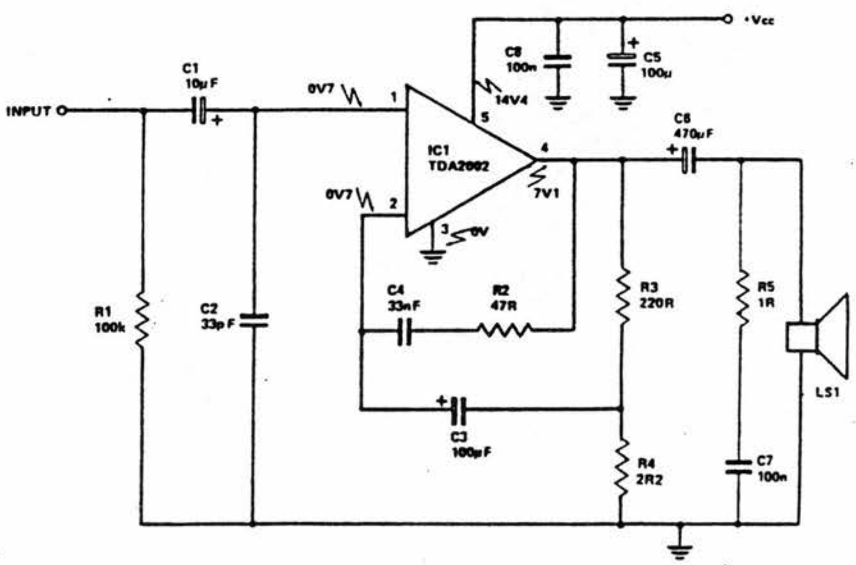
Due to its rather high current consumption the amplifier is not suitable for battery use. However, its supply requirements make it ideally suited for use with in-car entertainment units, possibly as a replacement for a defunct output stage.

CONSTRUCTION

The only difficulty that should be encountered in assembling the kit is with the mounting of the IC and the heatsink on the PCB. Firstly, fit the 5 PCB pins followed by the remaining components, taking care over the orientation of the electrolytic capacitors.

Insert and solder the IC so that the body is raised approximately 5mm above the board. Position the heatsink so that the tabs on its base pass through the holes provided in the PCB, and then bend the tabs outwards to secure it. Finally, bolt the IC directly to the heatsink.

If the amplifier is to be used in a car, care must be taken over earthing, although with negative earth this presents no real problems.

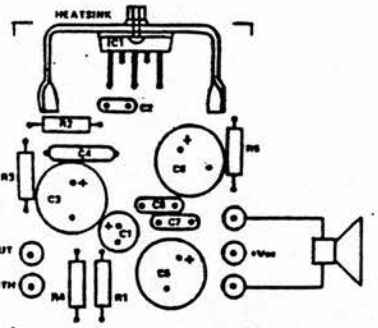


Circuit diagram of the 5W Audio Amplifier. Test voltages shown with a 14.4V supply and no input signal.

CIRCUIT DESCRIPTION

The low component count was made possible by utilising the TDA2002 integrated circuit. This is a complete class B audio amplifier, designed to deliver a high power output into low impedance loads. Short circuit protection, over voltage protection and thermal shutdown are all provided internally.

The circuit is a straightforward application of the TDA2002 with additional precautions against instability — R1 and C2 on the input and the R5/C7 Zobel network on the output. The input signal is fed via C1 to pin 1 of the IC and the output from pin 4 is coupled to the loudspeaker via C6. There are two feedback networks between pins 2 and 4: C4 and R2, which control the bandwidth and R3, R4 and C3 which determine the closed loop gain (R3/R4 = 220/2.2 = 100). C5 and C8 provide supply rail decoupling, thus enabling the IC to draw peaks of heavy current without the whole circuit becoming instable.



Component Overlay

SPECIFICATION

Supply Voltage	12-18V
Quiescent Current	45mA (Typ)
Power Output into 4Ω	
@ 16V	6.5W
@ 14.4V	5.2W
Input Sensitivity	
500mW Output (4Ω)	15mV
5.2W Output (4Ω)	55mV
Total Harmonic Distortion	
0.05-3.5W output (4Ω)	0.2% (max)
Input Impedance	150kΩ
Frequency Response	40-15,000Hz
Dimensions	36 x 48 x 33mm

Note: Will also drive 2Ω loads, with increase in power output but requires slightly larger heatsink.

PARTS LIST

Resistors all ¼W Carbon Film		
1	R5	1R
1	R4	2R2
1	R2	47R
1	R3	220R
1	R1	100K
Capacitors		
1	C2	33pF Ceramic
1	C4	33nF polyester
2	C7,8	100nF Ceramic
1	C1	10μF 16V Elect
2	C3,5	100μF 16V Elect
1	C6	470μF 16V Elect
Miscellaneous		
1	IC1	TDA2002
1		Heatsink
1		¼" 6BA
1		6BA Nut
1		6BA S/P washer
1		PCB
5		PCB pins

Appendix 4. Stimulus panel calibration tables.

The following tables give the details of the calibration of the stimulus electroluminescent panel for the apparatus measuring perceptual defence/vigilance. **Step** refers to the 99 incremental steps of brightness that the BBC microcomputer causes the stimulus electroluminescent panel to produce. **Volts** refers to the voltage produced by a photodiode in response to light stimulation from the stimulus electroluminescent panel. The photodiode is positioned so that the light measured is equivalent to that illuminating a stimulus slide. **Lux** refers to the incident illumination at the location of a stimulus slide, and is calculated by multiplying the voltage produced by the photodiode by 7.14. Table 1 gives the figures for August 1989; table 2 gives, for purposes of comparison, figures for November 1990.

Table 1
Stimulus panel calibration figures, August 1989

Step	Volts	Lux	Step	Volts	Lux	Step	Volts	Lux
1	0.168	1.200	34	0.316	2.256	67	0.903	6.447
2	0.169	1.201	35	0.328	2.342	68	0.926	6.612
3	0.170	1.214	36	0.340	2.428	69	0.950	6.783
4	0.171	1.221	37	0.352	2.513	70	0.974	6.954
5	0.172	1.228	38	0.365	2.606	71	0.998	7.126
6	0.173	1.235	39	0.378	2.699	72	1.023	7.304
7	0.174	1.242	40	0.392	2.799	73	1.047	7.476
8	0.176	1.257	41	0.406	2.899	74	1.075	7.676
9	0.177	1.264	42	0.422	3.013	75	1.100	7.854
10	0.179	1.278	43	0.437	3.120	76	1.126	8.040
11	0.181	1.292	44	0.452	3.227	77	1.152	8.225
12	0.183	1.307	45	0.468	3.342	78	1.179	8.418
13	0.186	1.328	46	0.484	3.456	79	1.205	8.604
14	0.188	1.342	47	0.500	3.570	80	1.232	8.796
15	0.191	1.364	48	0.518	3.699	81	1.260	8.996
16	0.195	1.392	49	0.538	3.841	82	1.288	9.196
17	0.198	1.414	50	0.556	3.970	83	1.316	9.396
18	0.201	1.435	51	0.574	4.098	84	1.345	9.603
19	0.205	1.464	52	0.591	4.220	85	1.374	9.810
20	0.210	1.499	53	0.609	4.348	86	1.403	10.017
21	0.215	1.535	54	0.628	4.484	87	1.431	10.217
22	0.220	1.571	55	0.648	4.627	88	1.461	10.432
23	0.225	1.607	56	0.667	4.762	89	1.490	10.639
24	0.230	1.642	57	0.687	4.905	90	1.520	10.853
25	0.236	1.685	58	0.708	5.055	91	1.549	11.060
26	0.243	1.735	59	0.728	5.198	92	1.579	11.274
27	0.252	1.799	60	0.748	5.341	93	1.609	11.488
28	0.260	1.856	61	0.769	5.491	94	1.639	11.702
29	0.268	1.914	62	0.791	5.648	95	1.670	11.924
30	0.276	1.971	63	0.813	5.805	96	1.700	12.138
31	0.285	2.035	64	0.835	5.962	97	1.731	12.359
32	0.294	2.099	65	0.857	6.119	98	1.762	12.581
33	0.306	2.185	66	0.880	6.283	99	1.792	12.795
						100	1.822	13.009

Table 2
Stimulus panel calibration figures, November 1990

Step	Volts	Lux	Step	Volts	Lux	Step	Volts	Lux
1	0.159	1.132	34	0.334	2.385	67	0.977	6.976
2	0.160	1.139	35	0.346	2.470	68	1.001	7.147
3	0.161	1.147	36	0.360	2.570	69	1.027	7.333
4	0.161	1.152	37	0.376	2.685	70	1.053	7.518
5	0.162	1.159	38	0.391	2.792	71	1.078	7.697
6	0.163	1.167	39	0.408	2.913	72	1.104	7.883
7	0.165	1.176	40	0.423	3.020	73	1.131	8.075
8	0.166	1.186	41	0.438	3.127	74	1.157	8.261
9	0.168	1.201	42	0.454	3.242	75	1.184	8.454
10	0.170	1.215	43	0.471	3.363	76	1.211	8.647
11	0.172	1.230	44	0.488	3.484	77	1.238	8.839
12	0.175	1.251	45	0.506	3.613	78	1.265	9.032
13	0.178	1.269	46	0.524	3.741	79	1.292	9.225
14	0.180	1.288	47	0.543	3.877	80	1.320	9.425
15	0.184	1.311	48	0.561	4.006	81	1.349	9.632
16	0.187	1.338	49	0.580	4.141	82	1.378	9.839
17	0.192	1.368	50	0.600	4.284	83	1.407	10.046
18	0.196	1.399	51	0.620	4.427	84	1.436	10.253
19	0.203	1.449	52	0.640	4.570	85	1.465	10.460
20	0.208	1.485	53	0.660	4.712	86	1.495	10.674
21	0.213	1.521	54	0.680	4.855	87	1.525	10.889
22	0.219	1.564	55	0.701	5.005	88	1.554	11.096
23	0.225	1.607	56	0.722	5.155	89	1.586	11.324
24	0.232	1.656	57	0.744	5.312	90	1.616	11.538
25	0.239	1.706	58	0.766	5.469	91	1.648	11.767
26	0.249	1.778	59	0.788	5.626	92	1.679	11.988
27	0.257	1.835	60	0.810	5.783	93	1.711	12.217
28	0.266	1.899	61	0.833	5.948	94	1.743	12.445
29	0.275	1.964	62	0.856	6.112	95	1.775	12.674
30	0.285	2.035	63	0.880	6.283	96	1.807	12.902
31	0.297	2.121	64	0.904	6.455	97	1.840	13.138
32	0.309	2.206	65	0.927	6.619	98	1.873	13.373
33	0.321	2.292	66	0.952	6.797	99	1.906	13.609
						100	1.938	13.837

Appendix 5. BBC Basic program used to run defensiveness testing session in experiment 7.

```
10 MODE 3
20   PROCinitialise
30   PROCintroduce
50 PROCdemo
120   PROCpractice_trials
125   PROCpause(150): REM to simulate manual slide change
130   VDU7
140   FOR slide=6 TO 22
145     ::
146     PROCchange_slide
150     PROCrandelay
160     PROCtitrate
175     PRINT£ channel, clicks
180     PROCreset
185     ::
195     ::
200   NEXT slide
210   VDU7
220   PRINT "First run completed.  Press button when ready to initiate second
run"
300   REPEAT
305   ::
310     PROCcheck_button(1)
315   ::
320   UNTIL button=1
325   VDU7
400   FOR slide=1 TO 17
405     ::
406     PROCchange_slide
410     PROCrandelay
420     PROCtitrate
440     PRINT£ channel, clicks
450     PROCreset
455     ::
465     ::
470     NEXT slide
600  VDU7
650  PRINT "End of second run.  Press button when ready for third run"
652  REPEAT
654  ::
656    PROCcheck_button(1)
657  ::
658  UNTIL button=1
659  VDU7
660  FOR slide=1 TO 17
662     ::
664     PROCchange_slide
666     PROCrandelay
668     PROCtitrate
670     PRINT£ channel, clicks
672     PROCreset
674     ::
678     ::
680   NEXT slide
682   VDU7
684   PRINT "Third run completed.  Press button when ready to initiate final
un"
```

```
686   REPEAT
688   ::
690     PROCcheck_button(1)
692   ::
694   UNTIL button=1
696   VDU7
698   FOR slide=1 TO 17
700     ::
702     PROCchange_slide
704     PROCrandelay
706     PROCtitrate
708     PRINT£ channel, clicks
710     PROCreset
712     ::
714     ::
716     NEXT slide
720  CLOSE£channel
730  VDU7
740  PRINT "End of session.  Thank you for participating."
800 ::
900 END
992 :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
1000 DEF PROCreset
1010   PROCset(via%,0)
1020   PROCset(via%,1):REM Direction downwards
1030   FOR i=0 TO 99
1032     PROCset(via%,2)
1034     REM PROCpause(1)
1036     PROCclear(via%,2)
1038     REM PROCpause(1)
1040   NEXT i
1090 ENDPROC
1092 :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
1100 DEF PROCchange_slide
1110   *motor 1
1120   PROCpause(50)
1130   *motor 0
1190 ENDPROC
1192 :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
2000 DEF PROCinitialise
2010   via%=&FE60
2012   viaDDR%=&FE62
2020   PROCset(viaDDR%,0)
2022   PROCset(viaDDR%,1)
2024   PROCset(viaDDR%,2)
2026   ::
2030 CLOSE£0 :REM close any file that has remained open
2040 X=RND(-TIME)
2050 time=TIME
2090 ENDPROC
2092 :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
```

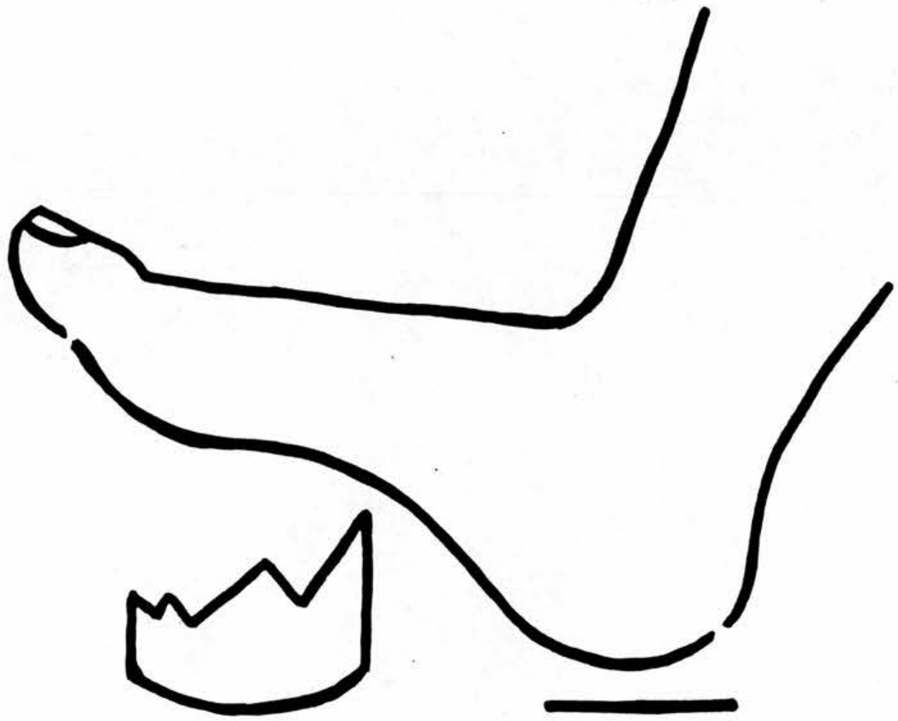
```
2100 DEF PROCtitrate_trials
2102   clicks=0
2104   maxclicks=100
2110   REPEAT
2112     ::
2120     clicks=clicks+1
2130     PROCincrease
2140     PROCcheck_button(1)
2142     ::
2150   UNTIL button=1 OR clicks=maxclicks
2170 ENDPROC
2192 :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
2200 DEF PROCincrease
2210   PROCset(via%,0):REM Enable chip select
2220   PROCclear(via%,1):REM Set direction UP
2230   PROCset(via%,2)
2232   PROCpause(5)
2234   PROCclear(via%,2)
2236   PROCpause(5)
2240   ::
2250   PROCclear(via%,0):REM Disable chip select
2290 ENDPROC
2292 :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
2300 DEF PROCcheck_button(duration)
2302   LOCAL time
2304   time=TIME
2310   button=0
2320   REPEAT
2322     ::
2324     press=ADVAL(0) AND 3
2326     IF press = 1 THEN button=1
2350   UNTIL TIME>=time+duration
2390 ENDPROC
2392 :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
2400 DEF PROCrandelay
2410   rng_choice%=RND(6)
2415   PRINT£channel, rng_choice%
2420     IF rng_choice%=1 THEN PROCpause(200)
2425     IF rng_choice%=2 THEN PROCpause(300)
2430     IF rng_choice%=3 THEN PROCpause(400)
2435     IF rng_choice%=4 THEN PROCpause(500)
2440     IF rng_choice%=5 THEN PROCpause(600)
2445     IF rng_choice%=6 THEN PROCpause(700)
2470 ENDPROC
2480 :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
2500 DEF PROCmanual_change
2505   REPEAT
2510     ::
2515     PROCcheck_button(1)
2520   UNTIL button=1
2525   IF button=1 THEN PROCchange_slide
2530 ENDPROC
2535 :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
```

```
2600 DEF PROCpractice_trials  :REM 4 manual trials plus set limit
2604   PRINT "Press button to start practice trials"
2608   ::
2610   FOR slide=1 TO 4
2620     PROCmanual_change
2630     PROCrandelay
2640     PROCtitrate_trials
2650     PRINT "Practice intensity level reached = ";clicks
2655     PRINT£ channel, clicks
2660     PROCreset
2670   NEXT slide
2674   PROCmanual_change
2676   PROCrandelay
2678   PROCset_limit
2679   PRINT "Press button to start run"
2680   REPEAT
2682     PROCcheck_button(1)
2684   UNTIL button=1
2688 ENDPROC
2690 :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
2700 DEF PROCset_limit :REM set max intensity level
2710   clicks=0
2720   REPEAT
2730     :
2740     clicks=clicks+1
2750     PROCincrease
2760     PROCcheck_button(1)
2770     ::
2780   UNTIL button=1
2790   PRINT "Practice intensity level reached = ";clicks
2792   maxclicks=clicks+10
2793   PRINT£ channel, maxclicks
2794   PROCreset
2795 ENDPROC
2798 :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
2800 DEF PROCtitrate
2810   clicks=0
2820   REPEAT
2830     ::
2840     clicks=clicks+1
2850     PROCincrease
2860     PROCcheck_button(1)
2870     ::
2880   UNTIL button=1 OR clicks=maxclicks
2890 ENDPROC
2895 :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
2900 DEF PROCdemo: REM display blank slide at full illumination
2910   PRINT "Press button to see demonstration slide"
2915   PROCmanual_change
2920     clicks=0
2940     REPEAT
2945     ::
2950     clicks=clicks+1
2960     PROCincrease
2965     ::
2970     UNTIL clicks=100
2972   REPEAT
2974     PROCcheck_button(1)
2976   UNTIL button=1
2980   PROCreset
2990 ENDPROC
2995 :::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
```

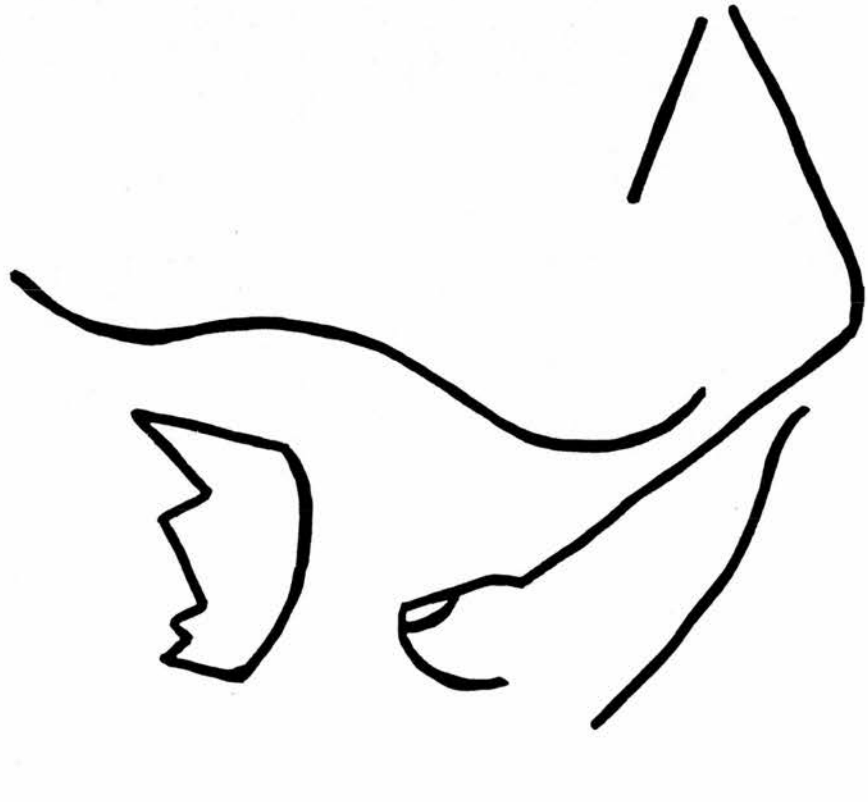
```
3000 DEF PROCintroduce
3005   PRINT "Welcome to Pandora's Box"
3010   INPUT "Participant name", subsesh$
3020   INPUT "Date", date$
3030   INPUT "Time", time$
3050   channel = OPENOUT(subsesh$)
3060     PRINT£ channel, subsesh$
3065     PRINT£ channel, date$
3070     PRINT£ channel, time$
3080 ENDPROC
7080 DEF PROCset(register%,bit%)
7090   LOCAL mask%
7100   mask%=2^bit%
7110   ?register%=(?register%) OR mask%
7120 ENDPROC
7130 ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
7140 DEF PROCclear(register%,bit%)
7150   LOCAL mask%
7160   mask%=2^bit%
7170   ?register%=(?register%) AND NOT mask%
7180 ENDPROC
7190 ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
8000 DEF PROCpause(delay%)
8002 LOCAL time
8010 time=TIME
8020 REPEAT:UNTIL TIME=time+delay%
8090 ENDPROC
8092 ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
```

Appendix 6. Full set of stimuli used in defensiveness testing session in experiment 7.

Emotional



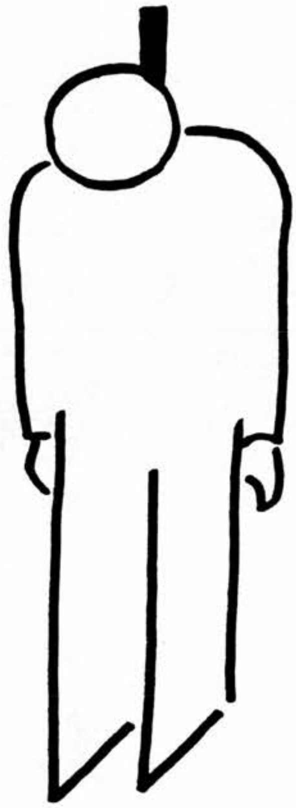
Emotional Control



Emotional

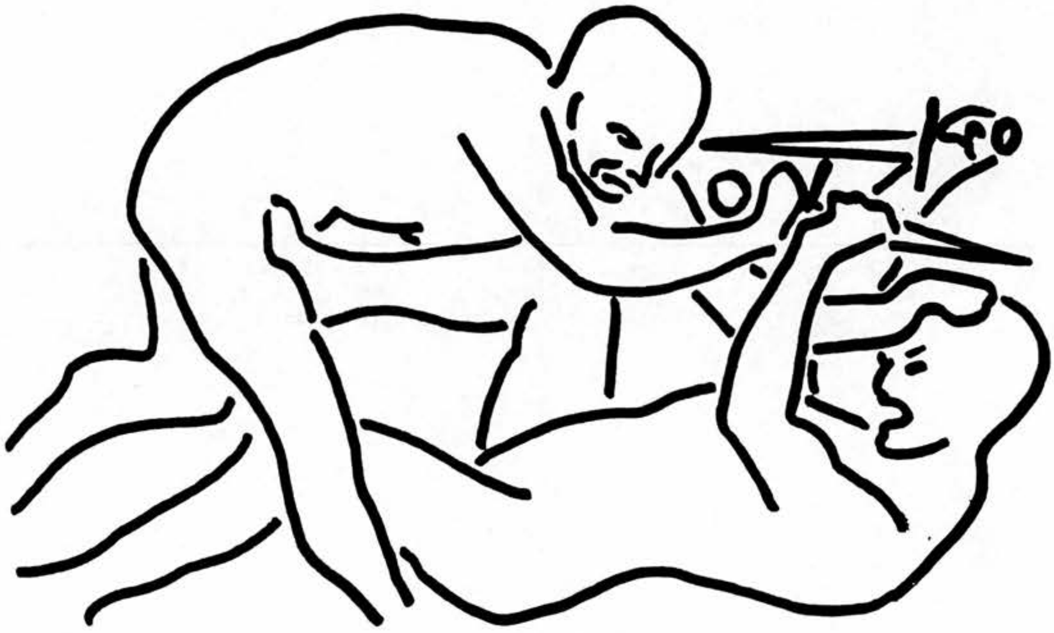
Emotional Control

Emotional



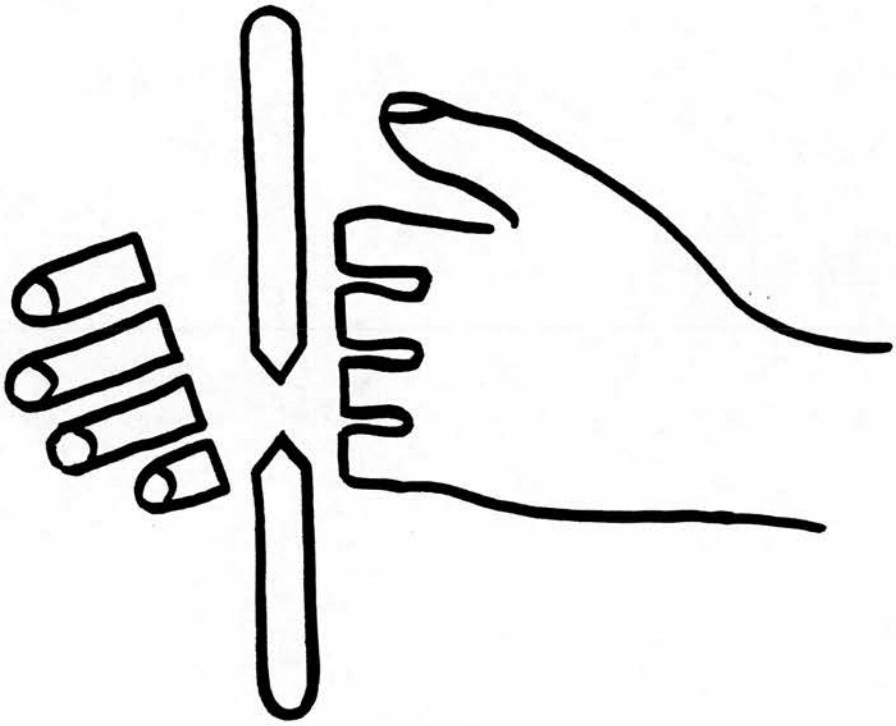
Emotional Control

Emotional

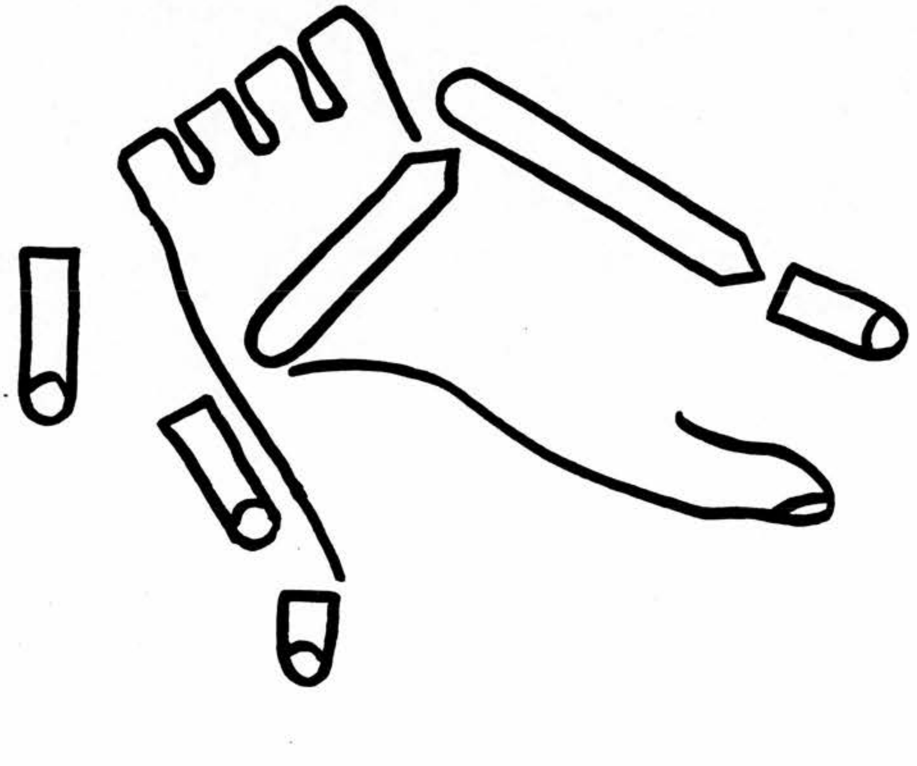


Emotional Control

Emotional

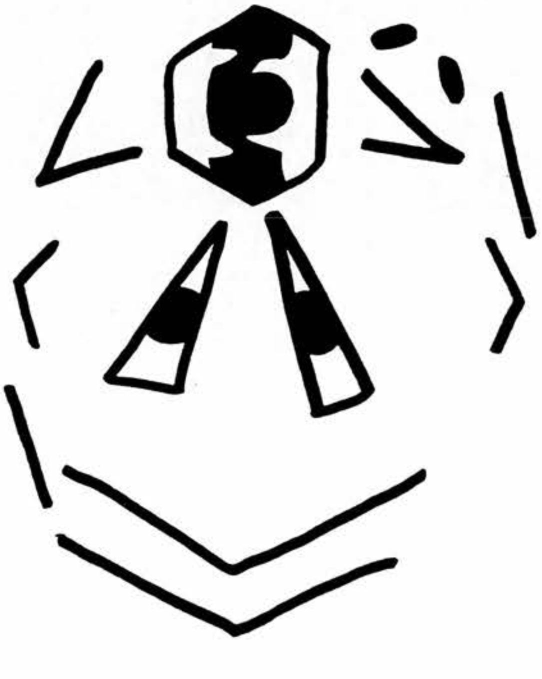


Emotional Control

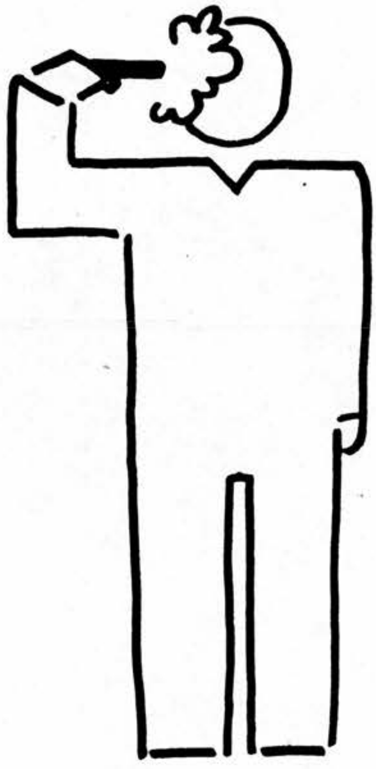


Emotional

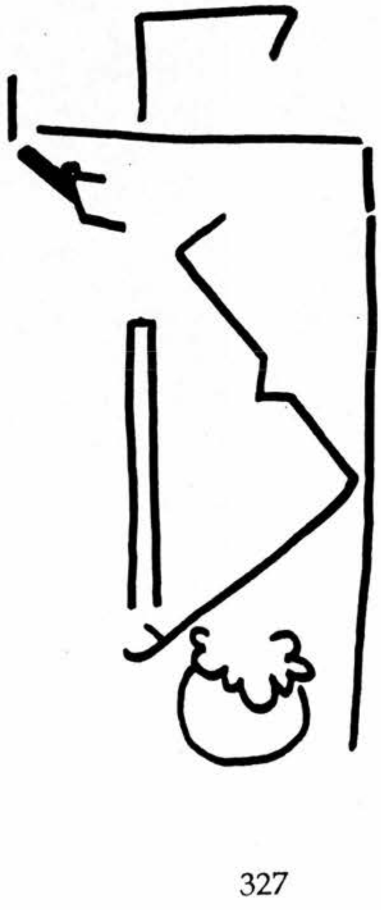
Emotional Control



Emotional

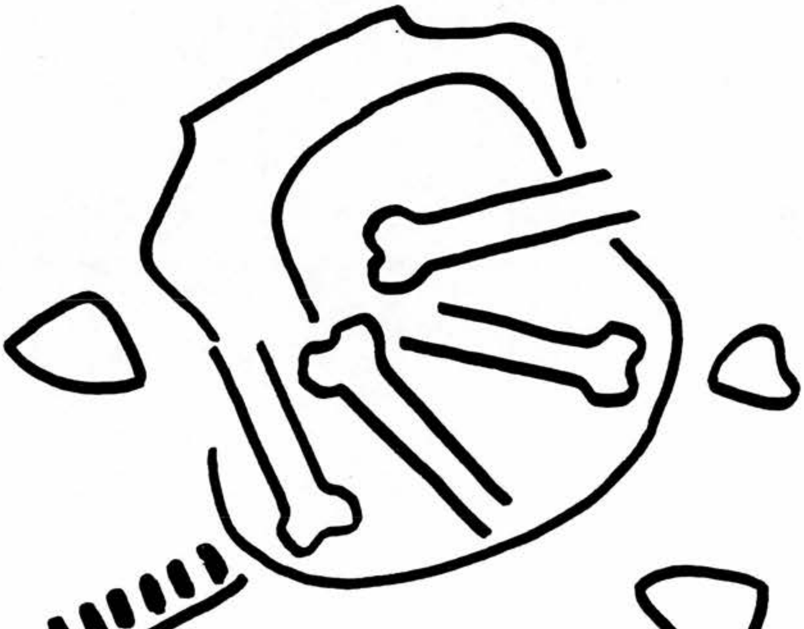


Emotional Control

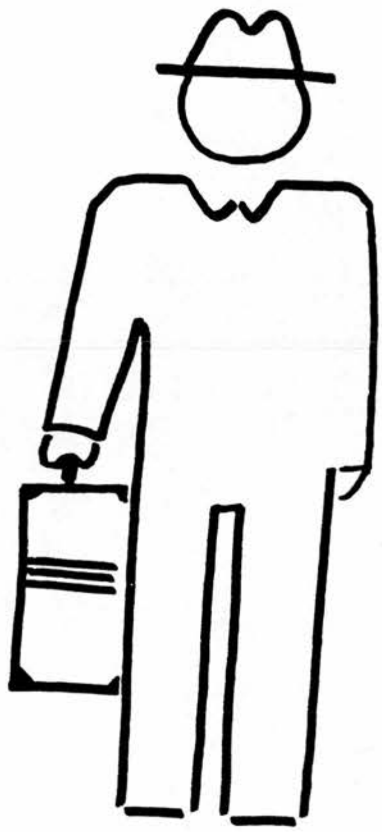


Emotional

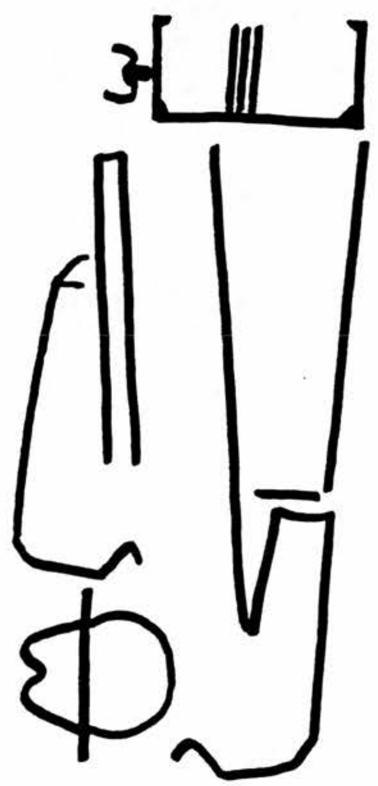
Emotional Control



Neutral



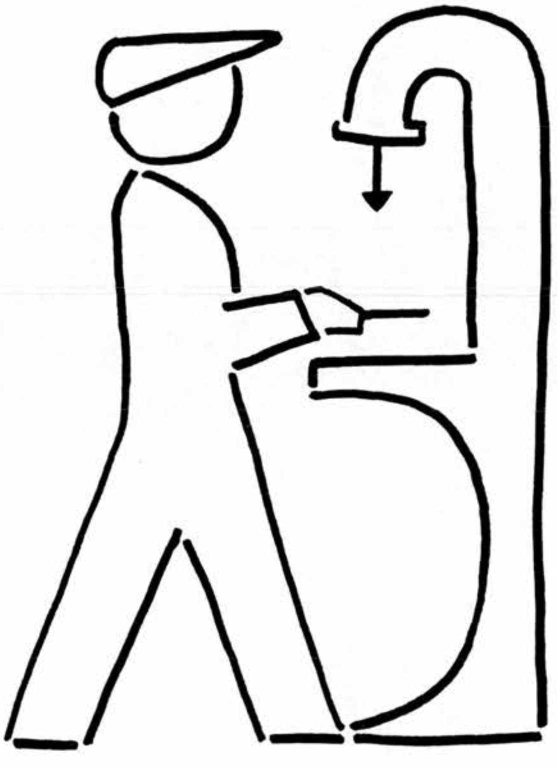
Neutral control



Neutral

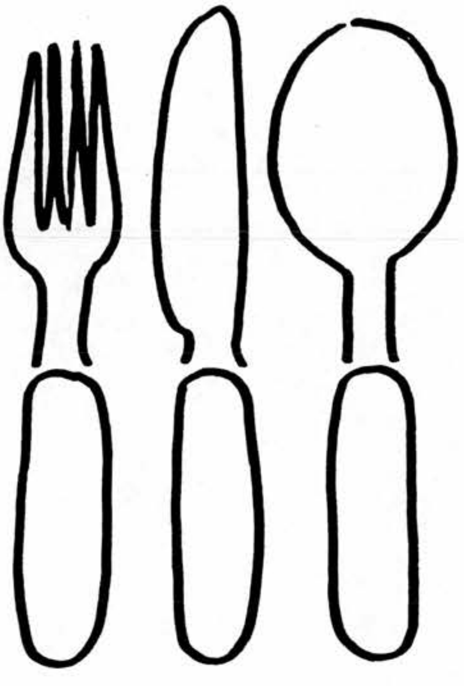
Neutral control

Neutral

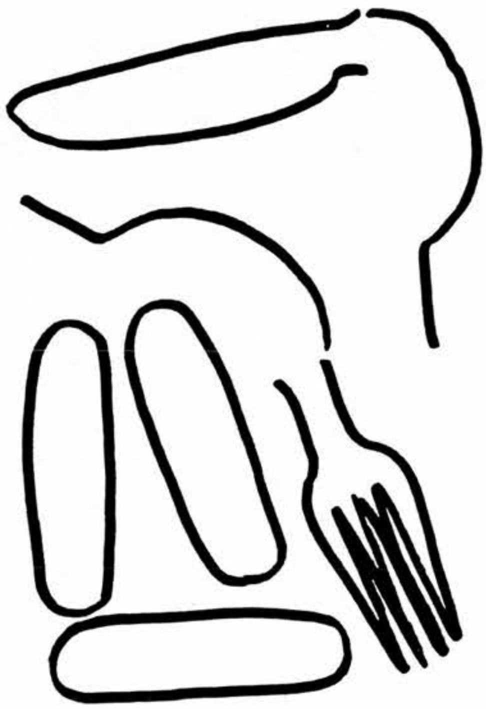


Neutral control

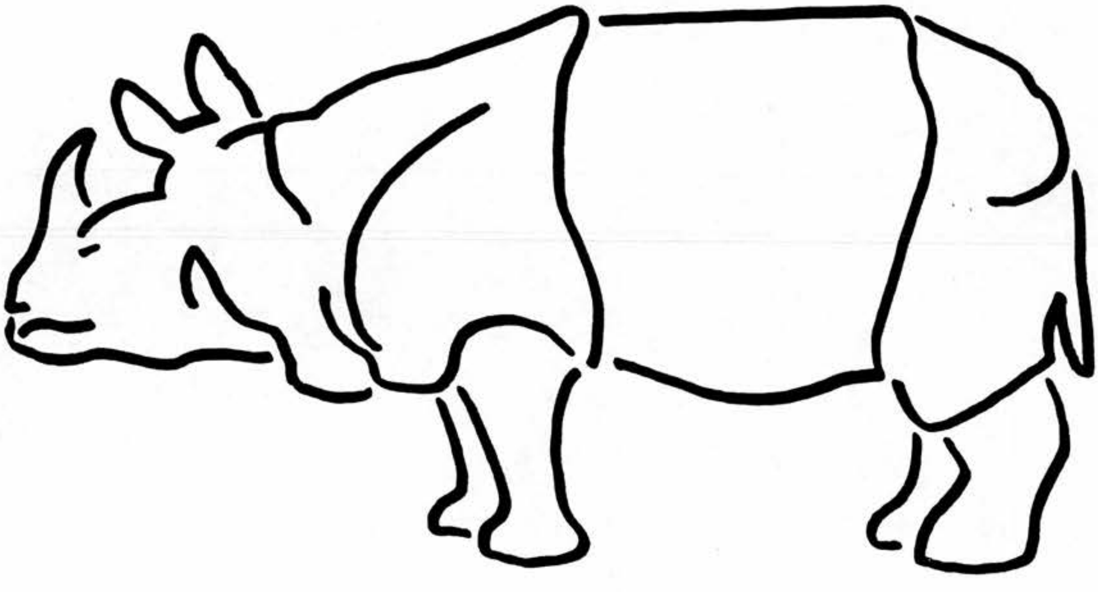
Neutral



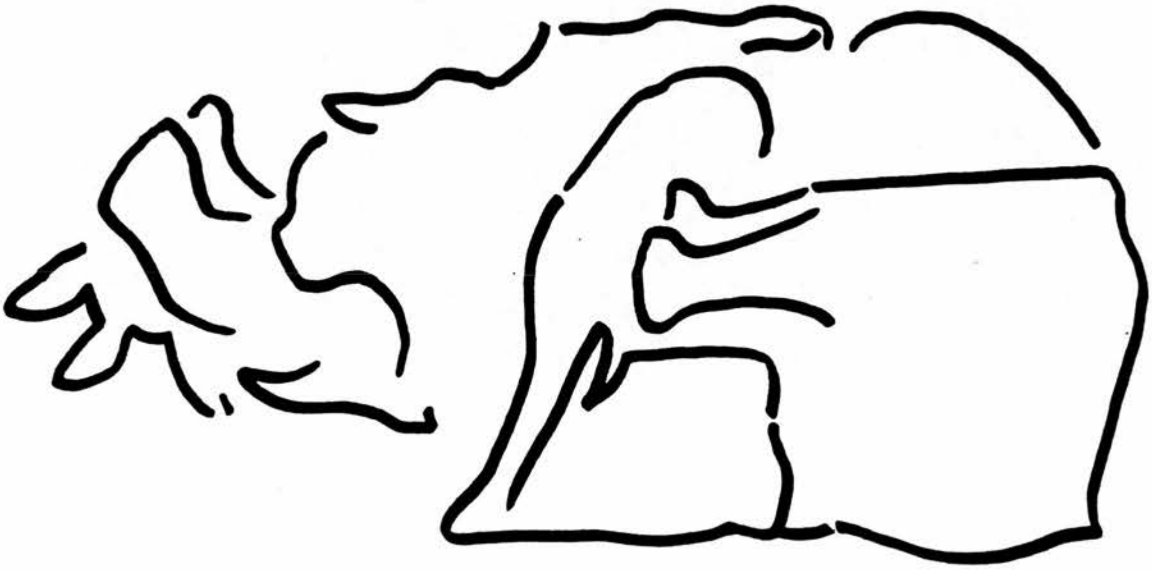
Neutral control



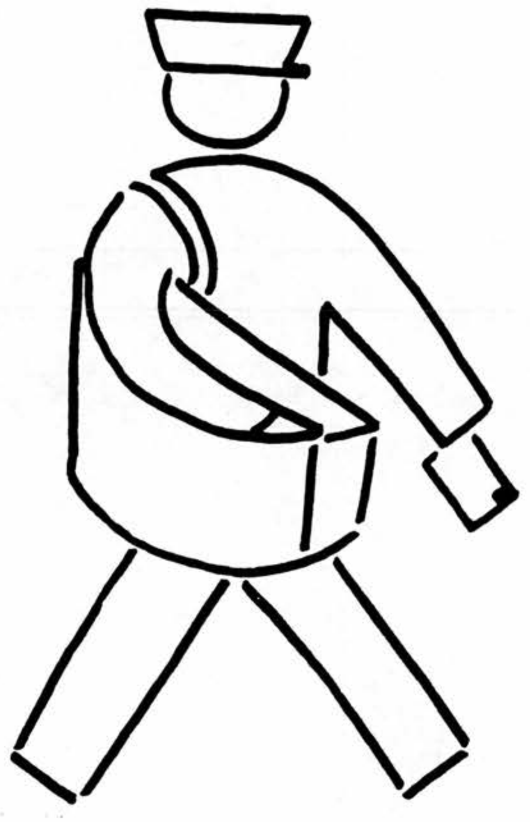
Neutral



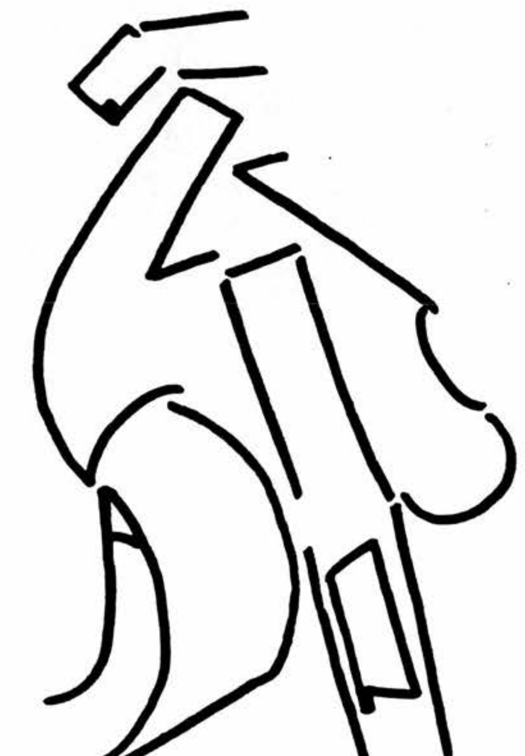
Neutral control



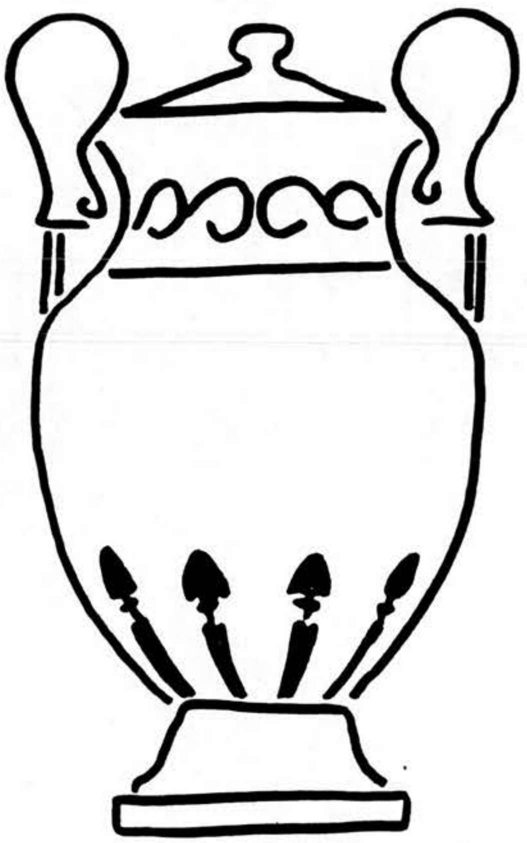
Neutral



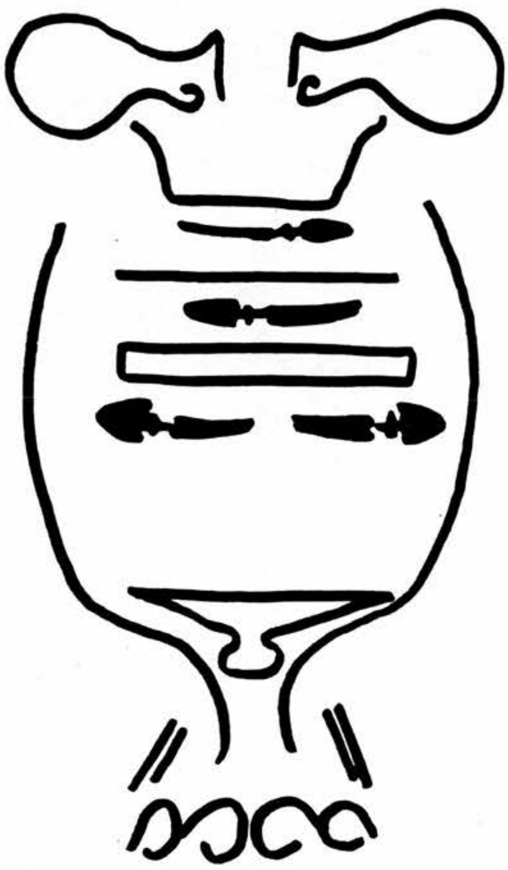
Neutral control



Neutral

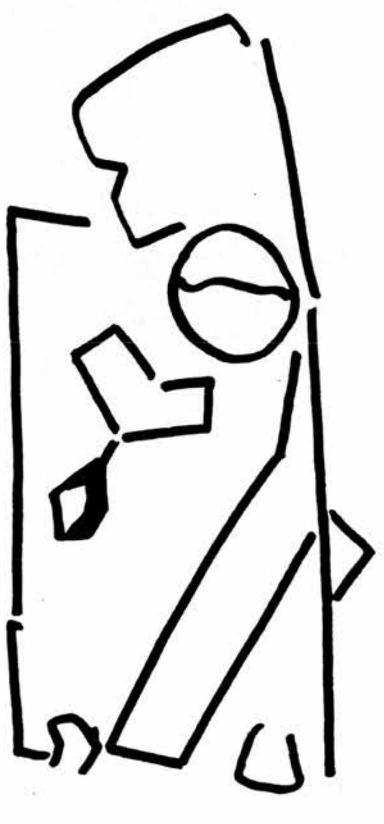


Neutral control



Neutral

Neutral control



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